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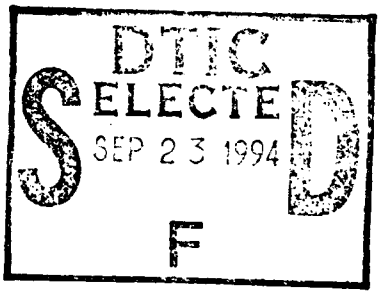

DEVELOPMENT OF AN ANALYSIS METHOD TO IDENTIFY THE ROOT CAUSES OF FINDINGS FROM THE AIR FORCE ENVIRONMENTAL COMPLIANCE ASSESSMENT AND MANAGEMENT PROGRAM (ECAMP)

THESIS

Frederick B. Cade, Captain, USAF

AFIT/GEE/ENV/94-05

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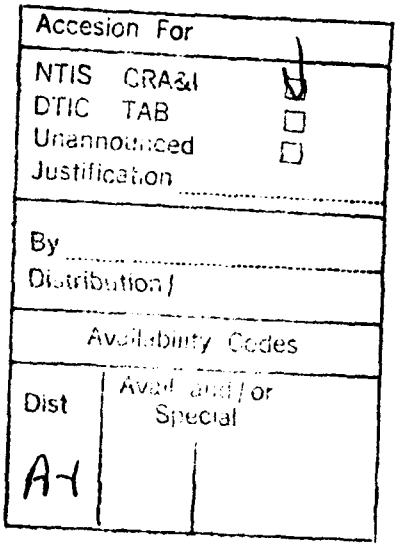

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THESIS

Presented to the Faculty of the School of Engineering

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Engineering and Environmental Management

Frederick B. Cade, B.S.

Captain, USAF

September 1994

Acknowledgments

My greatest thanks go to the members of the Graduate Engineering and Environmental and Management (GEEM) class of 94S who, over the course of the program, have provided support and the opportunity for lifelong friendship. Without my classmates (especially Capts Bobbie Moore, Anthony Copeland, and Gary Schneider) and the GEEM staff, this would experience would not have been as meaningful.

Secondly, I am especially grateful to my research advisor (and fellow soccer enthusiast) Major Aldrich. His willingness to provide critical perspective and alternative suggestions made the completion of this document possible. Thanks must also go to Capt Anthony Fontana for his numerous text reviews and resulting helpful comments as a committee member. His never-ending encouragement, and belief in my thesis effort will always be greatly appreciated. I must also thank Lt Col Amend for the support and enthusiasm for my work. His comments were very beneficial in keeping me focused.

I would be truly remiss if I failed to mention a group that has provided a source of encouragement and unlimited goodwill--WPAFB's Chapel 3 community. Thanks for the shoulders to lean on, the patience to listen to the same complaints over and over, the prayers for the completion of this process, and overall understanding they extended me.

Anytime a person moves to a new area, the thought of meeting new people can sometimes seem overwhelming. My transition to this area went smoothly because of the love shown to me by the following families to whom I am forever grateful: Jesse & Marilyn James, Greg & DeLisa Belloyne, Perry & Jackie Irby, and their respective children. Their fellowship and support aided greatly in my completion of this program.

I reserve the finally thank yous and appreciation to my immediate family. Thank you isn't a strong enough term for me to express the gratitude that I owe to my mother (Frances), father (Chester), sister (Caroline), and brothers (Filippe, and Christopher) for the phone calls, letters, warmth, and love that gave me the strength to succeed.

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Abstract

The Air Force is committed to being a national leader in achieving environmental compliance. This commitment is exemplified by the Air Force Chief of Staff's goal of no "notices of violation." This goal, however, has proven to be elusive. In the early 1990s, the number Air Force notices of violation (NOVs) increased by 73%, from 103 to 178. One of the reasons may be findings from the Environmental Compliance Assessment and Management Program (ECAMP) are not being utilized effectively.

This research developed an analysis method to identify root causes of ECAMP findings The resulting model emphasized the use of performance management standards to evaluate performance based problems detected by ECAMP process. The model incorporated motivational theory, job description, and performance analysis to identify these problems. The research also established a relationship between human performance problems and ECAMP findings.

The results from the analysis of the external ECAMPs of 33 ACC bases conducted from FY91-FY93 indicated that 79 percent of the ECAMP findings were performance based. Based on the research findings, it has been concluded that there is a need for methods that use performance management standards to identify causes of ECAMP findings.

DEVELOPMENT OF AN ANALYSIS METHOD TO IDENTIFY THE ROOT CAUSES OF FINDINGS FROM THE AIR FORCE ENVIRONMENTAL COMPLIANCE ASSESSMENT AND MANAGEMENT PROGRAM (ECAMP)

I. INTRODUCTION

General Issues and Trends

The Department of Defense (DoD), like all federal agencies, must comply with federal, state, and local environmental laws and regulations. In the late 1980's, the Secretary of Defense committed the DoD to becoming the leader among federal agencies in environmental compliance. However, achieving environmental compliance has proved to be an elusive goal (Salthouse et al, 1991:v). The trend of Notices of Violation (NOVs) being issued to DoD installations worsened instead of improved despite the active compliance efforts of the 1980's. From FY83 to FY89, the number of notices of violation (NOVs) issued to DoD facilities steadily increased from 140 to 626 (Salthouse et al, 1991:1-1). Figure 1 illustrates this trend.

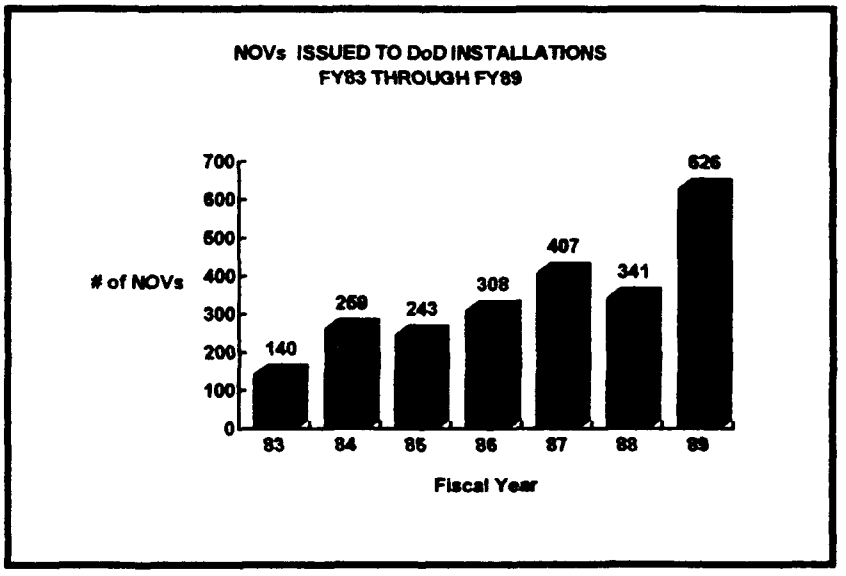

Figure 1. NOVs Issued to DoD Installations, FY83-FY89 (Salthouse et al, 1991:1-1)

In 1988, the Air Force, made a similar commitment, making effort to become the service within the DoD to lead the way in this area. The Air Force took a proactive stand and implemented the Environmental Compliance Assessment and Management Program (ECAMP). This program stresses a strongly proactive posture along with a supportive emphasis for helping USAF personnel identify and correct potential environmental problems internally (Mann, 1993:61).

Even with the implementation of ECAMP, however, the Air Force faced a similar problem that hampered the efforts of the initial DoD attempt to achieve compliance: the continued increase in NOVs. As Figure 2 from CY90 to CY92, the number of Air Force NOVs grew from 103 to 178, an increase of 73 percent. (DeZell, 1993:4).

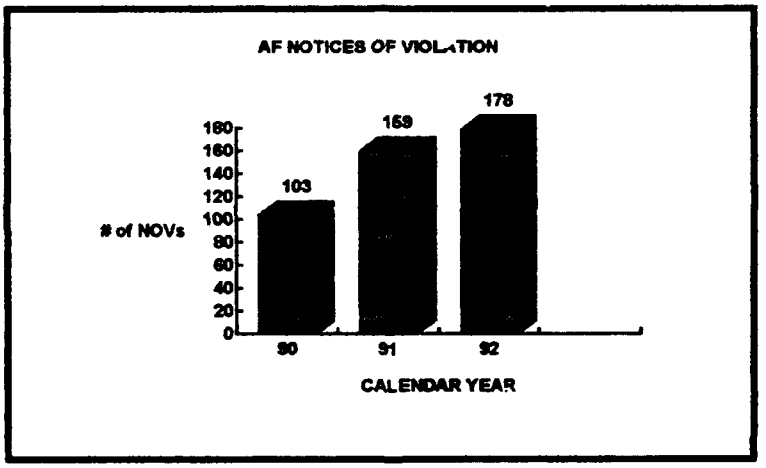

Figure 2. AF Notices of Violation, 1990 - 1992 (DeZell, 1993: 4)

This increasing trend is beginning to show signs of decline. A major factor in this reversal is a fundamental change in the practice of environmental management in the 1990s. In the 1980s, compliance, "end-of-pipe" control, and functional isolation were common practices in dealing with environmental problems (LaGrega et al, 1993:25). The "doctrine" stressed measures that fixed problems after they had already occurred, treating waste to make it less threatening instead of eliminating it at its source, and placing the responsibility of environmental clean-up on one office, group, or individual. The "doctrine" of the 1990s, on the other hand, stresses prevention over compliance, a life-

cycle approach to end-of-pipe, and multi-functional integration instead of isolation (LaGrega et al, 1993: 25). Now, the emphasis is on measures that prevent problems from occurring in the first place, systematic approaches to examine environmental and health consequences of a product at each stage of its life, and getting chief executive officers and senior managers involved in the environmental policy making and goal setting of companies. An example of the switch from this functional isolation to multi-integration occurred in the Air Force in early 1991. In a policy letter entitled "Environmental Leadership," General McPeak, the Air Force Chief of Staff, set a goal of "no notices of violation." This directive along with an increasing awareness of the benefits of proactive environmental compliance have helped to change the attitudes of many key people on Air Force installations. According to Capt Anthony Fontana, the prevailing attitudes about ECAMP and environmental compliance before the release of the policy letter, were analogous to highway motorist and speed limits. (Fontana, 1994).

Speed limits on the highway are set and motorist choose the times they are going to obey. One of those times is when a police officer is in the area. Environmental compliance requirements are like posted speed limits. People like to comply with the requirements when the threat of regulators exists (Fontana, 1994). When the threat is gone, so is the urgency to comply. Also, too many installations used ECAMP as a compliance hammer instead of as a self-assessment. They used the program as a checklist for complying with environmental policy. The problem with this approach is that ECAMP is only one tool of many available to help an installation build a strong overall compliance program. Cahill emphasizes this point in his book Environmental Audits when he writes the following:

> An auditing program is but one of many tools needed to develop and maintain an effective environmental management program. An audit on its own can only identify, not correct, environmental management deficiencies. Although problem identification is the first step in achieving improved results, if an organization is unwilling to take steps to correct problems and shortcomings identified during an audit, it probably would

> have been better off not conducting the audit in the first place (Cahill, 1989: II-1)

Simply put, ECAMP is a program to help the base assess where it stands environmentally. In order to create a better program, environmental compliance must become a habit instead of a convenience. General McPeak's emphasis on the compliance issues helped to usher in a newer attitude. The trickle down effect of senior leadership showing interest and that attitude being passed down the chain is readily apparent in the Air Force. More so than in the earlier years, people are actively seeking ways to better enhance their environmental awareness at many Air Force facilities. According to Maj. Steven E. Hoarn, Chief of Environmental Oversight, HQ ACC, base level personnel are actively cooperating with their major command (MAJCOM) counterparts to reduce the number of environmental violations (Hoarn, 1994). This increased level of cooperation is having some positive effects on the elimination of NOVs in the Air Force. From the third quarter of FY92 through the first quarter of FY 94, the number of NOVs has decreased from 196 to 152, a 23 percent decline, as shown by Figure 3 (Walsh, 1994). The figure shows that Air Force environmental managers are reducing the total number of infractions--the number of NOVs issued is decreasing while the number of open enforcement actions being closed is increasing. To reduce the number of NOVs from 152 to zero, the Air Force will have to better utilize ECAMP findings to anticipate and prevent future environmental problems.

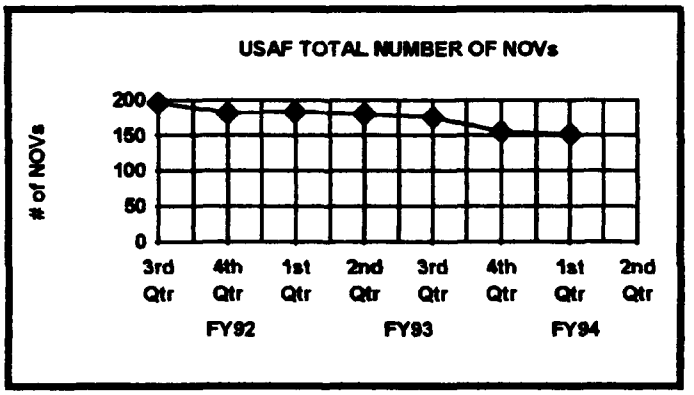

Figure 3 USAF Total NOVs (FY92-FY94) (Walsh, 1994)

Research Hypotheses

To more effectively use the ECAMP findings, the root causes of problems must be identified and corrected to eliminate these repeat findings and produce more effective results. This is based on the apparent cause and effect relationship between the lack of identification of the "root" or underlying problems causing repeat findings and the number of ECAMP findings. Because many of the ECAMP problems are occurring from installation to installation and reoccurring from annual ECAMP to ECAMP at the same installation (and leading to similar NOVs), this leads to the conclusion that symptoms rather than root causes are being addressed; the underlying sources of the problem are not being identified. Dennis Moberg and David Caldwell, the authors of Interactive Cases in Organizational Behavior, use the following analogy of an iceberg to illustrate this point:

> Symptoms are similar to the tip of the iceberg (see Figure 4). They indicate the presence of the problem (the entire iceberg) but are insufficient at defining its size and scope. Problem causes lurk under the surface, hidden from view. Treating symptoms is like sawing off the top of an iceberg at sea level. Those symptoms disappear, but the untreated causes show up on some other form--the iceberg buoys up to reveal other symptoms. Consequently, treating symptoms alone almost guarantees an ongoing battle of shearing off iceberg tips until the problem causes have dissipated naturally (Moberg and Caldwell, 1988:26)

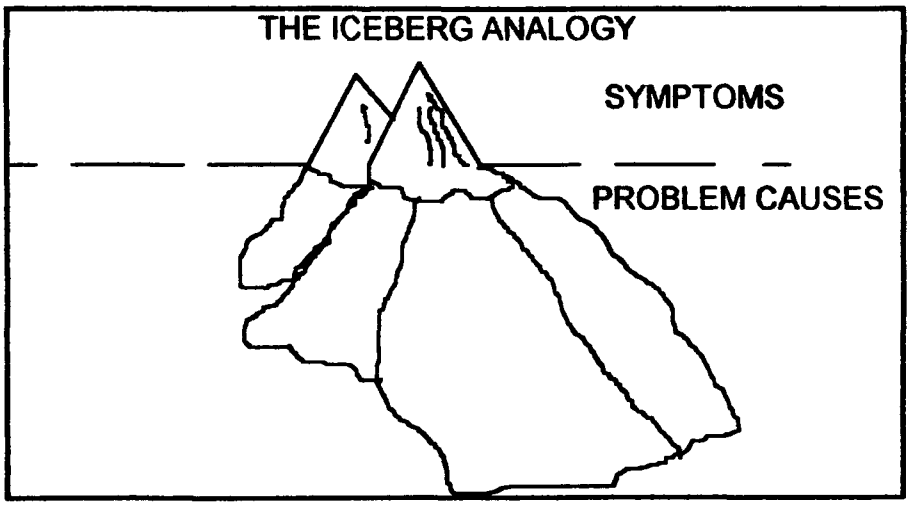

Figure 4 The Iceberg Analogy (Moberg and Caldwell, 1988:26)

In addition to the relationship between the lack of identification of root causes of and the number of ECAMP findings, another potential relationship that needs to be addressed is the one between performance based problems and the root causes of ECAMP findings. If this association can be established, then performance management standards can be used to identify sources of many of the current ECAMP problems. The basic principle behind these management standards is that particular problems exist because certain criteria is not being currently met or has not been met in the past. Performance management techniques have been used successfully in business-related matters and should be able to be applied to appropriate environmental problems, resulting in similar successes.

Research Objectives

The purpose of this research is to develop a model to identify the major root causes of performance-based ECAMP findings using performance management standards. Identifying and then eliminating these problems this process will help to ensure more favorable compliance results (i.e., reduce the number of recurring NOVs). In order to achieve this goal, two key terms must be defined: "root causes" and "performance-based problems." A root cause is "the most basic reason(s) for an incident, which if corrected, will prevent occurrence or recurrence" (HQ ACC Root Cause Analysis Policy Letter, 1994:3). A performance based problem occurs when there is "a difference between someone's actual performance and his desired performance" (Mager and Pipe, 1970:7). An understanding of these terms is necessary in accomplishing the following research objectives:

1. Establish a direct relationship between ECAMP findings and human performance problems.

2. Demonstrate how the combined efforts of motivational theory, job description, and performance analysis, can be used to identify the "root causes" of performance-based ECAMP findings;

3. Develop a model to identify "root causes of performance-based ECAMP findings

Scope

The scope of this project will be limited to Air Combat Command (ACC) bases. The bases under this command include the largest number in CONUS and provide a profile of those bases with flying missions.

The ECAMP information used for analysis was obtained from ACC bases using ECAMP reports ranging from 1990 to 199?. The three year period represents the time in which all the bases performed an external ECAMP.

HQ ACC/CEV has defined six areas that it considers the root causes of enforcement actions: training, funding, management and oversight, policy and guidance, manpower, and a miscellaneous other category (these will be discussed in more detail later in the paper). This effort will apply the ACC classifications to ECAMP findings, emphasizing the three areas which have the most direct application to performance type problems: training, and management and oversight, and policy and guidance.

Operational Definition of NOV

For this research effort, a Notice of Violation (NOV) is defined as" a violation of environmental laws or regulations resulting in enforcement actions by the EPA, state or local regulators. . ." (DeZell, 1993:9). The term NOV used in the early 1980's made it equivalent to an enforcement action of today. However, to properly address the usage of the term, an NOV is one type of regulatory enforcement action. Others include letters of noncompliance, notices of noncompliance, and warning letters. A regulatory enforcement action, however, is not necessarily a NOV. From this point on, the term regulatory enforcement action will be used to address the broad spectrum of regulatory environmental violations.

Thesis Organization

Chapter II of this study presents a background review of the importance of environmental auditing in industry, and the related principles that have been implemented by the Air Force in the form of ECAMP. The purpose is to provide general information about the basics and needs for environmental audits.

Chapter III review the literature on the "performance chain," a type of performance management standard, and how elements that form it are important to identifying root causes of performance problems. Special emphasis will be placed on reviewing the principles of performance analysis, motivational applications and theories, and effective job descriptions.

The next chapter presents the findings from a data analysis performed to define "attackable" traits used to identify performance type problems. The chapter will discuss the data collection, the common problems found in each ECAMP protocol area, and the results from the data.

Chapter V discusses the development of the proposed model. The criteria used for developing the model and an explanation of the 8 step process are presented.

The final chapter, results and recommendations, will provide a brief overview of the problem and the conclusions drawn from the research. It will provide recommendations for follow-on work in the area.

II. BACKGROUND

Environmental Auditing

Environmental laws in the United States continue to grow more important as the general level of environmental awareness grows in this country. Because of the public's increasing familiarity and concern with the environment, the regulatory arm of the government is taking a firmer stance against violators, both in public and private industry. The Federal Facility Compliance Act (FFCA) is an example. Federal facilities are no longer immune from punishment from civil and administrative penalties and fines for environmental violations. The implications from this action is that organizations must now police themselves to ensure compliance with all federal, state, and local legislation. One successful "self-policing policy" that is being used effectively in both public and private industry is the environmental audit.

Private industry was the first to capitalize on the important benefits of environmental audits. Not only is avoiding environmental problems cheaper than correcting them, but companies also enhance their public image by incorporating audits into their culture. Mann notes that because an audit program is not required by law, "an auditing program adds to a company's positive public image not only by helping the company avoid negative publicity due to fines, but by demonstrating a proactive attitude toward protecting the earth's environment" (Mann, 1993: 60-61).

Environmental auditing in the United States has been utilized for approximately 15 years with a varying degree of success. Gregg contends that audits are a "valuable way for companies to check environmental compliance, reduce exposure to violations and liability, and to improve the environmental operations at facilities" (Gregg, 1993:15).

The key U.S. laws which provided the major push for auditing were the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). RCRA imposed criminal sanctions against those who knowingly and willfully violated hazardous waste laws and a number of these

sanctions resulted in major fines and prison time for violators (Gregg, 1993:15). The strict and several liability clauses in CERCLA placed organizations at financial risk at any location where the activities could cause potential damage to human health or the environment. (Gregg, 1993:16).

The EPA defines environmental audits as "systematic, documented, periodic, and objective review[s] by regulated entities of facility operations and practices related to environmental requirements" (EPA Environmental Auditing Policy Statement). Cilione simplifies this definition by stating that the audit is "a written record of the activity associated with an audit program and that it is performed on a periodic basis with an objective view of the facility's operations and practices to ensure that applicable environmental regulations are met" (Cilione, 1992:50). Managers should view an audit as a self-imposed compliance tool to direct activities to minimize environmental incidents and create awareness and not as part of a non-voluntary regulatory requirement. As Cilione iterates, an environmental audit is "the basis of good sound business practice to ensure that facilities are always within compliance and are exemplary neighbors to the community and industry as well as to its employees" (Cilione, 1992:50-51).

Audit programs typically examine air and water quality, hazardous and solid wastes, and toxic substances (Duffy and Potter, 1992:1708). The two that most common types of programs that focus on these protocols are compliance and operational management audits (Hunt and Wilkens, 1992:366; Gregg, 1993:17).

Compliance audits include an investigation by internal or external environmental specialists of a facility's compliance to assess its performance in complying with applicable environmental laws and regulations. These audits focus on existing and potential environmental hazards, releases, and discharges for the purposes of:

1. complying with environmental laws and regulations;
2. identifying nonregulatory risks, including potential liability associated with off-site disposal and citizen suits;

3. evaluating the need to remediate existing environmental conditions and the methods used to do so, and;

4. assessing the cooperation's or facility's vulnerability to environmental enforcement proceedings. (Hunt and Wilkens, 1992:365)

Management audits evaluate a cooperation's or facility's management systems or procedures for:

1. identifying environmental noncompliance;

2. assessing environmental risks;

3. informing the corporation's decision makers of such risks;

4. designing and implementing measures to prevent environmental violations and mitigate nonregulatory environmental risk, and;

5. remediating or otherwise responding to potential or actual environmental hazards. (Hunt and Wilkens, 1992:377)

The objectives of an environmental audit program vary widely between organizations, depending upon their cultures and structures. The most common type of audit objective is the documentation of a facility's compliance status and the identification of corrective measure for violations (Gregg, 1993:16). Successful audit programs share several other common attributes that include:

- Top management support and corporate commitment,
- Trained and qualified auditors,
- Quality assurance for consistency and reliability of the auditing function
- Audit function independent of audited activities,
- Follow-up systems to track implementation of corrective actions,
- Defined and documented procedures for conducting the audit
- Comprehensive data collection
- Written documentation and reporting of findings to management

An important part of the audit program is the development of a permanent instrument to monitor a facilities compliance activities. By incorporating its principles into the coporate mission, environmental auditing will encourage a more proactive stance

toward good environmental stewardship. The Air Force took such a proactive posture in 1988 with the implementation of ECAMP.

ECAMP

Concept

The Environmental Compliance Assessment and Management Program (ECAMP) is the Air Forces' official environmental audit program. This assessment is a comprehensive self-evaluation system "for achieving, maintaining, and monitoring compliance with environmental laws and regulations through the use of environmental compliance evaluations and management action plans at Air Force installations"(AFI 32-7045). ECAMP evaluations help ensure that the installations are complying with environmental statutes and their Federal, state, and local implementing regulations (AFI 32-7045). These evaluations are accomplished by utilizing either external or internal assessments. External compliance assessments are conducted at least once every three years by MAJCOM personnel or contractors not associated with the installation. Internal compliance assessments are conducted each calendar year (except in years when external evaluations are performed) by installation personnel under the direction of the installation's Environmental Protection Committee (EPC).

ECAMP was developed to comply with the mandates of Executive Order 12088 "Federal Compliance and Pollution Control Standards" in 1978. It stated that "each Federal agency must ensure the compliance of all facilities under its jurisdiction and cooperate with EPA, state, and local agencies to prevent, control, and abate pollution"(ECAMP Student Outline Guide, 1993:3). ECAMP was further encouraged by a 1986 EPA Environmental Audit Policy Statement which did the following:

> [S]pecially encourage[d] Federal facilities to adopt sound environmental management practices, specially environmental auditing, to help achieve and maintain compliance with applicable environmental

requirements as well as to help identify and correct unregulated environmental hazards. (ECAMP Student Outline Guide, 1993:3)

This policy was a direct result of the increase in regulatory requirements. These requirements combined with the threat of criminal liability of federal employees for violations and enforcement actions by various Federal and state agencies made the implementation of a compliance oriented program.

In 1986, the first ECAMP manual was published by the Air Force (ECAMP Student Outline Guide, 1993:3). In 1988, a policy implementing ECAMP and mandating the first assessment by January 1990 was established. In 1990, the Air Force published the ECAMP regulation AFR 19-16 (ECAMP Student Outline Guide, 1993: 3). The major objectives of ECAMP as directed in Air Force Initiative 32-7045, which replaced AFR 19-16, are as follows:

a. Improve Air Force environmental management worldwide.

b. Improve Air Force environmental compliance and compliance management in the United States and Possessions.

c. Build supporting financial programs and budgets for environmental compliance requirements.

d. Ensure that MAJCOMS, installation commanders, environmental protection committees, environmental coordinators, bioenvironmental engineers, and natural resource managers environmental programs are effectively addressing environmental problems.

e. Anticipate and prevent future environmental problems.
(AFI 32-7045, 1993:4)

The ECAMP Process

The ECAMP program is designed to "resolve minor deficiencies through procedural changes, education, and training and devote additional resources to alleviate major compliance deficiencies" (DeZell, 1993:19). It is performed as a three phase process. The phases are:

1. Pre-assessment activities;
2. Site assessment activities; and
3. Post assessment activities (ECAMP Student Outline Guide, 1993:4)

The pre-assessment activities include a review of all relevant regulations and directives for the installation being assessed. Special emphasis should be place on regulated areas and operations and areas that are cause for environmental concern (AFI 32-7045, 1993:5).

Site assessment activities include conducting records searches, interview, and site surveys to determine the compliance status of the installation. The data collected during this phase should be reliable and relevant to provide a sound basis for assessing the findings and recommendations that are required to write the preliminary environmental findings (AFI 32-7045, 1993:6).

Post-assessment activities include a period of review and comment on the preliminary environmental finding by each installation and the development of management action plan to address unresolved findings and track each compliance finding and environmental practice issue (AFI 32-7045, 1993:7). This will take place within 60 days of the preliminary findings.

Findings

ECAMP findings can be classified into the following categories:

1. Positive
2. Negative
   a. Significant
   b. Major
   c. Minor

Positive findings are especially noteworthy achievements of the base or its personnel.

Significant findings are problems that require immediate action. They pose or have a high likelihood of posing a direct and immediate threat to human health, safety, the environment, or the installation mission (AFI 32-7045, 1993:31).

Major findings require action, but not immediately. This category "identifies conditions that usually result in a notice of violation from regulatory agencies." (AFI 32-7045, 1993:30). Major findings may pose a future threat to human health, safety, or the environment or ability to accomplish the mission (AFI 32-7045, 1993:30).

Minor findings are mostly administrative actions. They may also involve temporary or occasional instances of noncompliance with regulatory agency requirements (AFI 32-7045, 1993:30).

ECAMP Protocols

The ECAMP inspection process evaluates an installation's compliance based on the protocols described in Table 1. Each protocol identifies key federal legislative requirements, typical state and local regulations, and DoD and AF specific requirements (DeZell, 1993: 19). These protocols provide the foundation for the ECAMP evaluation.

TABLE 1 ECAMP PROTOCOLS

Hazardous Materials	Hazardous Waste
POL	Water Quality
Special Programs • Polychlorinated Biphenyls (PCBs) • Asbestos, Radon	Pesticide Management
Air Quality	Natural and Cultural Resources
Solid Waste	Noise Management

III. LITERATURE REVIEW

Overview

Whenever a job is not performed as expected or the work force is not working as hard as the manager thinks they can, the individual employees are usually blamed. However, this can be faulty finger pointing. According to W. E. Deming, only 15 percent of all quality problems can be traced to a particular worker or tool with the other 85 percent resulting from faults in the company's system (Bolt and Rummler, 1982: 39). To achieve the level of performance from workers to satisfy management and help the organization's overall productivity, the manager needs to pay close attention to the concept of the "performance chain."

The performance chain is a relationship between the worker and his environment that affects his performance and productivity. Performance is a product of the nature of the job itself (goals and standards found in job description), the resources available to the individual (means), the individual (competence, motivation), the feedback received (motivation), and the consequences of performing (motives) (Bolt and Rummler, 1982: 40, Carr, 1993:54). Performance is likely to be less than expected if any of the key elements is weak (Carr, 1993:52). It is vital that managers understand that optimum productivity is the result of all the elements being present and effective in the chain (Bolt and Rummler, 1982: 40). People perform most effectively under the following circumstances:

- The task or job is clear. Employees know what is expected of them.
- The resources required to do the job are readily available, including information, time, money, and the proper tools.
- The individual has the capacity, skills, and knowledge required to do the job.
- The individual receives frequent feedback about how well he or she is doing vis-à-vis the job expectations.
- The individual is satisfied by the consequences or rewards that follow successful performance of the job.

(Bolt and Rummler, 1982: 40)

All performance is determined by the effectiveness of the balance between the individual performer and his or her immediate work environment. When the performance chain is strong, the employees under the system perform successfully (Bolt and Rummler, 1982: 44).

This chapter reviews the literature to explain the key factors of the performance chain. It describes the importance of job descriptions (the nature of the job-goals, opportunity), and motivational theories and applications (motives, feedback) in performing tasks. The concepts of performance analysis are looked as a technique to find the root causes of breakdowns in the performance chain. These elements are important in identifying the root causes of performance based ECAMP findings.

Motivational Theories and Applications

A man may well bring a horse to the water,
But he cannot make him drinke without he will.
John Heywood

We have all heard the popular axiom, "You can lead a horse to water, but you can't make him drink!" How many times, however, have we really analyzed the importance of the statement. When looking at this from a motivation standpoint, we see that the statement contains some basic principles. We know that there are many possible explanations for the horse's refusal to drink. According to Ken Matejka, "[t]he behavior (refusing to drink) is not the problem but the symptom . . . the cause may be internal or external" (Matejka, 1991:7). Internal causes can vary from lack of thirst to stubbornness to fear while the external causes can be improper rewards and punishments to barriers to goals (Matejka, 1991:7). The point is that no one really knows what motivates the horse to act. To understand the problem, the horse owner either has to have known something about the horse in question beforehand or be willing to learn about the horse in order to influence the horse to drink.

This situation is similar to that facing managers. If employees are to accomplish the company goals or objectives, the manager needs to understand how to influence the employees' choices. Like the horse owner who can't get the horse to drink, the manager also cannot motivate his employees; motivation comes from within a person, not from outside sources (Quick, 1986:24). No matter how hardworking the manager is, employees must commit to the company objectives, these will never be met. Motivation refers to the behavior that people choose (Quick, 1986:9). People decide whether to perform just well enough to meet minimum standards or put out a full effort and turn in a superior performance.

In order for them to get the most out of their employees, managers must learn how to influence or channel the behavior of their workers Quick states that managers can involve employees in working toward objectives by following these basic principles:

1. Tell people what you [the manager] expect them to do.
2. Make the work worth doing and doable.
3. While employees are trying to do what you expect, let them know how they are doing.
4. When they have done what you expected them to do, reward them

(Quick, 1986:i)

These steps provide the foundation for influencing people's behavior. The process includes proper communication, feedback, and a rewards system as the keys to motivate people. But to fully understand how these areas combine to provide the proper motivating techniques, a few basic theories of motivation in the workplace must be examined.

Theories of Motivation

Maslow's Hierarchy of Needs. In 1943, psychologist Abraham H. Maslow published the article, "A Theory of Human Motivation," that explained his hierarchy theory of motivation (Massie, 1981:89). This theory is based upon his observations that there is a definite rank-order priority of human needs (Beach, 1985:297). The needs are in

a specific order and until the more basic needs are fulfilled, a person will not strive to meet higher needs. Maslow classified the needs into five categories: physiological, safety, social, self-esteem, and self-actualization. Hanks provides the following description of the needs:

- *Physiological needs*: food, drink, shelter, sex, and so on. If a person doesn't ever have these needs met, he'll never move into the next level of need
- *Safety needs*: Security, stability, freedom from fear
- *Social needs*: Having love, friends, intimacy, contact with others
- *Esteem needs*: Feeling important, useful, competent, needed by others
- *Self-actualization needs*: Being able to reach one's potential to grow, to progress. This need will never even be sought until all the other needs are met.

Figure 5 illustrates the relationship of the needs to one another.

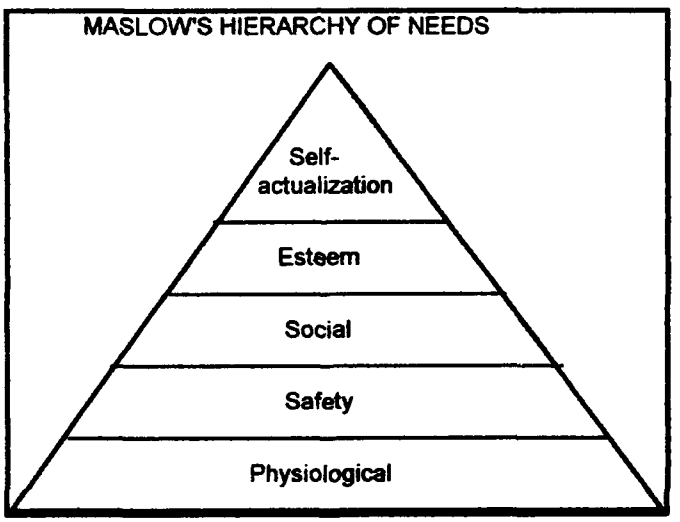

Figure 5 Maslow's Hierarchy of Needs (Hanks, 1992:135)

John Adair, the author of Understanding Motivation, points out that this way of presenting Maslow's hierarchy makes it look as if the greatest needs are in the lower ranges and then narrow in size as one progresses up the pyramid (Adair, 1990:22). But physiological needs, for example, are limited: one can only eat so many meals a day. In fact there are less limitations the further up one goes. Thus, to be realistic when using the

pyramid model, it makes more sense to invert it, with physiological needs in the tip and progressing up to self-actualization needs in the base (Adair, 1990:22). Another way of presenting Maslow's hierarchy and incorporating Adair's concern is shown in the following figure:

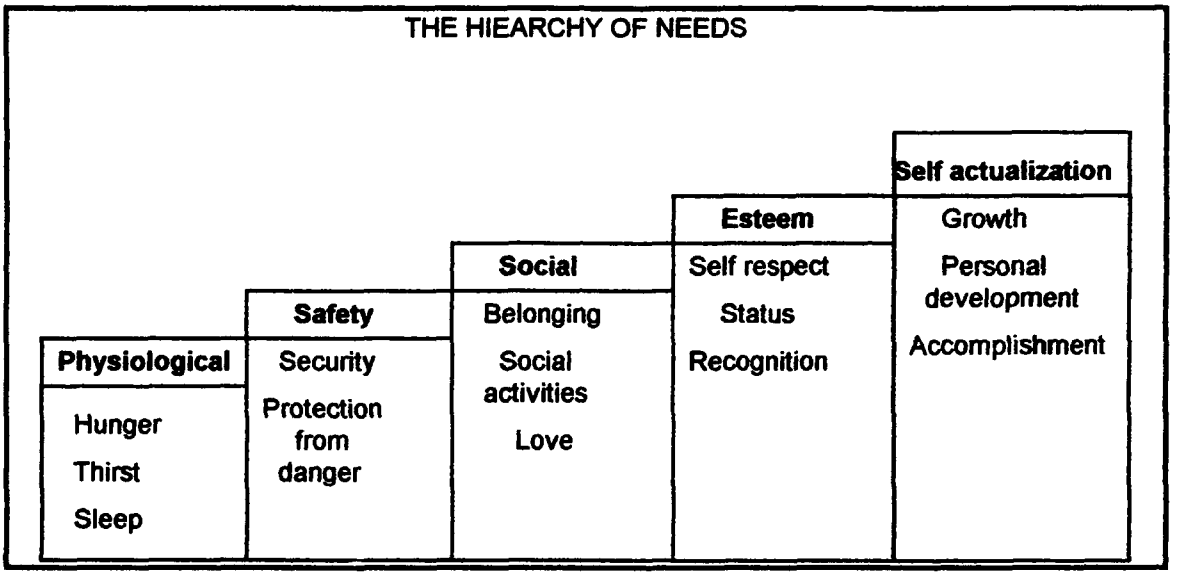

Figure 6 The Hierarchy of Needs (Adair, 1992:24)

As stated earlier, Maslow says that a person first seeks to satisfy the lower needs before moving on to the higher. Thus, a person is less likely to strive for security or love when his basic need is to satisfy a hungry stomach.

Understanding that employees are looking for certain needs to be fulfilled from the job allows managers to better evaluate the employees. By focusing and directing job efforts toward satisfying the different level of needs, the manager will assists workers in working more effectively toward accomplishing the company goals and the job at hand.

Motivation-Hygiene Theory. In the late 1950's, Professor Frederick Herzberg and his associates conducted research that was designed to test the idea that man has two sets of needs: (1) his lower-order needs to avoid loss of life, hunger, pain, and other deprivations and (2) his need to grow psychologically (Beach, 1985:300-301). The results

of his research found that one group of factors led to high levels of job satisfaction. These factors were labeled motivators because each was associated with strong effort and superior performance (Krietner and Kinicki, 1992:176). Herzberg considered the following to be motivators:

1. *Achievement*. The successful completion of a job or task; a solution; the results of one's work.
2. *Recognition of achievement*. An act of praise or some other notice of the achievement.
3. *Work itself*. Tasks as sources of good feelings about the work done; extent of duties.
4. *Responsibility*. For one's own work or that of others; new tasks and assignments.
5. *Advancement*. An actual improvement in status or position.
6. *Possibility for growth*. Potential to rise in the organization. (Quick, 1980:38)

The presence of any of these factors may motivate. (Quick, 1980:38)

The other group of factors that influence how an employee views his job are called hygiene or maintenance factors (dissatisfiers). They do not motivate or provide job satisfaction; however, if they are not present, they may cause dissatisfaction. (Quick, 1980: 39). Quick considers the following factors to be dissatisfiers:

1. *Supervision*. A manager's willingness or unwillingness to teach or to delegate responsibility can result in things running smoothly or being irritating.
2. *Company policy and administration*. Structure, good or bad communications, adequate or inadequate authority, harmful or beneficial effects of company and personnel policies.
3. *Positive working conditions*. Environmental and physical conditions.
4. *Interpersonal relations with peers, subordinates, and superiors*. The social and working relations with others on the job.
5. *Status*. How one's position or standing is perceived by others; privileges of rank.
6. *Job security*. Stability, tenure.
7. *Salary*. Compensation
8. *Personal life*. How aspects of the work-such as long hours or required transfer and relocation--affect the employee's personal life. (Quick, 1980:39)

Sussman states that the "major implication of Herzberg's two-factor theory is that, no matter how satisfying the job is, increased performance only results from the presence of the motivating factors" (Sussman, 1979:31) This explains why some workers are satisfied with their jobs and perform just well enough to get the job done while others are motivated by their jobs and are able to maintain a higher level of performance.

Intrinsic versus Extrinsic. Another common theory of motivation is the one that classifies behavior as either intrinsic or extrinsic. Beach describes intrinsic motivation as that "which occurs while a person is performing an activity in which he gains satisfaction from engaging in that activity itself" (Beach, 1985:302). He continues by explaining that "extrinsic motivators are incentives or rewards that a person can enjoy after finishing work" (Beach, 1985:302). Thus, employees that exhibit intrinsic behavior are motivated by the job itself, independent of the financial rewards from the job. Conversely, some people are motivated because the job provides money that can then be used to purchase other rewards (i.e., cars, boats, homes, etc.). The bottom line is that these two types of behavior exist in the workplace, and to establish a sound "motivational climate," the manager must be willing and able to work with both (Beach, 1985:302).

McGregor's Theory X and Theory Y. In 1960, Douglas McGregor wrote a book titled, The Human Side of Enterprise, which has become the basis for the modern view of people at work (Kreitner and Kinicki, 1992:21). The psychologist formed two contrasting sets of assumptions concerning people at work. The first set, labeled Theory X, claimed managers generally perceived that, were it not for their vigilance, most employees would not do a good job because they were averse to work (Quick, 1980:11). The pessimistic and negative authoritarian philosophy of Theory X states:

1. The average human being has an inherent dislike of work and will avoid it if possible.

2. Because of this human characteristic of dislike of work, most people must be coerced, controlled, directed, and threatened with punishment to get them to put forth adequate effort toward the achievement of organizational objectives.

3. The average human being prefers to be directed, wishes to avoid responsibility, has very little ambition and wants security above all.

Conversely, McGregor formulated a second set of assumptions that considered employees to be potentially creative, trustworthy, and cooperative (Beach, 1985:32). His Theory Y philosophy centered on a modern and positive set of assumption about people. This theory assumes:

1. Work is a natural activity, like play or rest.
2. People are capable of self-direction and self-control if they are committed to objectives
3. People generally become committed to organizational objectives if they are rewarded for doing so.
4. The typical employee can learn to accept and seek responsibility.
5. The typical member of the general population has imagination, ingenuity, and creativity.
6. Control and threats are not the only means of persuading people to work.
7. Under the conditions of modern life, the intellectual potentialities of the average human being are only partially utilized.

(Kreitner and Kinicki, 1992:21, Quick, 1980:11)

Theory Y sees people working because it is natural to them. They don't work to avoid something (i.e., punishment), but to gain something of value to them (Quick, 1980:12). Quick states that supportive management "is aware of the need to remove obstacles which inhibit job performance" while authoritarian management "imposes controls and penalties which can inhibit job performance" (Quick, 1980:12).

An interesting aspect of these X and Y theories is that they can become self-fulfilling. If a manager creates an atmosphere that expects people not to put forth an effort unless compelled to do, this is the type work situation that will prevail. On the other hand, managers who expect people to do a good job and believe that the people themselves want to excel usually get this type of work atmosphere.

Vroom's Expectancy Model. Expectancy theory holds that people are motivated to behave in ways that "produce desired combinations of expected outcomes" (Kreitner and Kinicki, 1992:212). It does not consider specific needs; rather, it is used to predict behavior in any situation in which a choice between two or more alternatives must be made (Schaefer, 1977:11, Kreitner, 1992:212).

In 1964, Victor Vroom formulated a model of expectancy theory in his book Work and Motivation. His basic premise was that motivation is a process of "governing choices" (Massie, 1981:96). He believed that people perceive what they do as important in achieving "outcomes" (Schaefer, 1977:10). A person's motivation level is based on *expectancy* (the probability that a person places on a belief that a particular degree of effort will be followed by a particular level of performance) and *valence* (the positive or negative value an individual places on outcomes). In other words, a person weighs the likelihood that certain behavior will allow him to reach a goal successfully. If he thinks that a particular act will be successful, he is more likely to select it. This is vital for managers to realize because it gives insight into the way in which employees view certain tasks. If the manager can provide an environment in which the employees feel that there is an above average chance of completing a task or meeting a performance goals, they will make the effort or expend the extra energy to accomplish the task. The manager can help the situation by providing positive consequences for the completion of the tasks (i.e., rewards, recognition, etc.).

The preceding sections have been concerned with the descriptive theories of motivation--they have described and explained theories that have been put into practice. According to Schaefer, it is important for managers to be familiar with these because: (1) they help focus attention on real, basic human needs as they might be exhibited on the job, (2) they may help the manager clarify his or her own feelings and opinions about motivation, and (3) they serve as guides to managerial action (Schaefer, 1977:12).

Studying these theories is fundamental for effective communication with employees. (Sussman, 1979:31)

Sussman concludes that these theories can assist managers in becoming more effective because each of the theories has a common, underlying assumption: "what motivates one person does not necessarily motivate another person" (Sussman, 1979:32). Understanding that there are "different strokes for different folks" allows the manager to adapt his behavior to suit each employee. He will be better able to tailor his interactions with each individual more suitably.

Applications

Now that the major theories of motivation have been briefly summarized, Quick's four precepts of motivation can be explored. This precepts provide an application of the previous theories that allow a manger to channel employee behavior toward accomplishing the goals of the organization or company.

Tell People What You Expect Them To Do. Everyone has been in or knows someone who has been in the following situation:

> A man pulls into a small town, late for an appointment, and is lost. He stops at a gas station for help and is given the following directions: "Go straight until you get to the corner where the black cow is grazing in the pasture. It's on your right. Turn left. Go a hundred, two hundred yards--you'll see a little old house set back from the road among the trees. Go past that place until you get to the spot where the old tree was hit by lightning. Turn right. Pretty soon you'll see a dirt road with Farmer Smith's orange tractor parked beside it. Go straight past it and you'll get there. If the tractor isn't there, come back and get more instruction." (Hanks, 1982:8)

The man probably ended up frustrated and missed his appointment because the instructions were not clear and virtually impossible to follow. Hanks uses these example

to express how many managers are guilty of the same type of unknowing "misdirection". They wonder why the employees who once seemed capable of competently performing now fail to do so. One of the reasons for this "change" might be that the employee doesn't know what the boss wants. Hanks writes that "the more the other person understands of what you want, the more he'll be able to meet your expectations" (Hanks, 1982:8). When a manager wants someone to do something, he should ensure that the "want" is clearly communicated. Matejka offers managers the following advice for communicating with employees:

- Talk straight.
- Expect only what you clearly and directing ask for.
- Focus on performance, not pet peeves.
- To get more, trying adding, "why" to your "what."
- Give frequent feedback.
- Praise what goes well. (Matejka, 1991:26-27)

By giving employees a clear definition of their jobs, their work relationships, and the expected results from their work, the manager keeps from setting his employees up for failure and eliminates a potential motivational problem.

Make the Work Worth Doing and Doable. Set realistic and challenging targets for employees to achieve. Adair states that people are "capable of transcending self in the pursuit of high and demanding ideals" (Adair, 1992:97). Using this as a guide, the manager wants to find a balance between high and demanding and unattainable. If objectives are unrealistic, they will demotivate people. If, on the other hand, the objectives are too easy to attain, they become uninspiring and have the same effect on employees. Finding a happy medium is the key to this precept.

While Employees Are Trying to Do What You Expect, Let Them Know How They Are Doing (Feedback). Feedback is communication that helps individuals keep their behavior "on target." Kreitner defines feedback as "*objective* information given to a

worker regarding his/her job performance" (Kreitner and Kinicki, 1992:777). It helps employees to achieve goals. AF Pamphlet 13-2, The Tongue and Quill, provides the following criteria for giving useful feedback:

1. Feedback should describe rather than judge. Avoiding judgmental language reduces the other person's need to respond defensively.

2. Feedback is both *positive* and *negative*. A balanced description of a person's work takes both the strong and weak points of the performance into account.

3. Feedback should be *specific* rather than general. General statements about another person's work do not indicate the performance elements that he or she needs to change . . . .

4. Feedback should be directed at a person's work or behavior, not at the person.

5. Feedback should be directed at behavior that the receiver can control. Only frustration results when a person is reminded of a shortcoming that he or she cannot control.

6. Feedback should take into account the needs of *both* the receiver and the giver of the feedback. What the giver says to a person about his or her work performance reflects not only upon his or her moment. (AFP 13-2, 1985: 73-75)

Feedback is not only an important communications tool but also a crucial motivational asset. By periodically reviewing their performance and "directing" their efforts, managers can assist employees in doing the job more effectively and efficiently. This type of feedback is very effective when combined with performance reviews, appraisals, etc. It can provide motivation to employees to enhance performance and productivity, as will be seen in the "job description" section of this chapter.

When They Have Done What You Expected Them to Do, Reward Them.

Employment is an exchange process--the employee gives his or her abilities and efforts to the organization and in exchange the organization rewards the employee for such efforts.

(Grant, 1988:76) According to Grant, usually only a small portion of the motivating potential of an organization's bonuses is ever tapped because managers miss many opportunities to realize the high productivity that can come from a well-managed system of employee rewards. (Grant, 1988:78) In order to maximize their potential, rewards have to be sold by management. Management must communicate what they have to sell (rewards) and then promote them.

Rewards or incentives reinforce behavior; they make it more likely that the behavior will recur (Schaefer, 1977:71). Hanks expresses this thought with the statement that "what the organizational system rewards the most is what you get the most of" (Hanks, 1982:96). If a manager wants his/her employees to feel that their contributions are important, he/she must show this to the workers. In order to get the most out of rewards, there are certain guidelines that should be followed.

1. *Tie rewards to needs*. Workers have multiple needs, therefore several types of rewards will be required. Managers should design rewards to meet those needs and remember that it involves an ongoing effort because people's needs do not remain static.

2. *Assure rewards are of sufficient magnitude*. The reward's value is directly correlated with its magnitude. Performance that deserves modest praise should be praised modestly. If the employee turns in outstanding work, then appropriate reinforcement to show that the work is deemed outstanding is in order. (Grant, 1988:78, Quick, 1980:57)

3. *Ensure the reward's fairness*. Considerable attention must be given to ensure that employees perceive their rewards as fair in relation to what fellow workers are receiving. To an employee, only a fair and just reward has any meaning (Grant, 1988:78)

4. *Proper timing is imperative*. The timing when rewards are received is nearly as important as what is received. What the employee has done that is praiseworthy is fresh in his/her mind. Recognizing the performance immediately offers greater assurance that the behavior will be repeated in the form the manager wishes. It also emphasizes the value placed on the specific performance. (Grant, 1988:78)

5. *Talk up the value of the rewards.* Point out the many benefits of a reward, such as showing how it can be used and explaining why it's valuable, significantly affects how its value is perceived. Showing enthusiasm at the time it is discussed also adds to its perceived value.

6. *Do not camouflage rewards.* Rewards must stand out and be highlighted. Managers should not sandwich praise among a dozen other topics. Employees must be allowed ample time to think about the bonuses and then enjoy them. (Grant, 1988:79)

7. *Issue rewards in a public forum.* Managers should praise employees in public. An award, or reward, received among co-workers will have a longer lasting impact. (Grant, 1988:80)

8. *Make rewards contingent on performance.* Workers value promotions more highly if they are not automatic after a certain amount of service. Allowing an employee to prove his/her performance capabilities to get an advancement boosts the reward's worth in his/her mind. (Grant, 1988:80)

9. *Be consistent in giving rewards.* If people know they will be rewarded for good performance, they have to trust the management will be consistent. When praiseworthy performance occurs, the manager should make an effort to recognize it. Once the behavior is repeated consistently, reinforce it occasionally. An employee who does the same kind of activity regularly and consistently will tire of hearing the same statement of positive reinforcement each day. (Quick, 1980:56)

10. *Increase the exclusiveness of the rewards.* The value of a reward generally increases as it scarcity increases. Managers who want employees to vale promotions should restrain from handing out too many. (Grant, 1988:81)

When giving out rewards, it is imperative also to ensure that productive and effective performance is reinforced. As Quick emphasizes, "reward the behavior you want; don't reward the behavior you don't want." (Quick, 1980:58). Many managers reward behavior in a employee that may have little to do with productivity. Also, many rewards that are based on factors other than job performance are given with good intentions. However, the manager risks the misunderstanding that the reward is given for a behavior that is not necessarily related to performance. The following example illustrates both of these points:

> A man went fishing one day. He looked over the side of his boat and saw a snake with a frog in its mouth. Feeling sorry for the frog, he reached down, gently took the frog from the snake, and set the frog free. But then he felt sorry for the snake. He looked around the boat, but he had no food. All he had was a bottle of bourbon. So he opened the bottle and gave the snake a few shots. The snake went off happy, the frog was happy, and the man was happy to have performed such good deeds. He thought everything was great until about ten minutes passed and he heard a knock against the side of the boat. With stunned disbelief, the fisherman looked down and saw the snake was back with *two frogs!* (LeBoeuf, 1987:149)

In granting rewards for any reason, the manager needs to make sure that employees see the relationship between good performance and rewards. (Quick, 1980:59). They must realize the while other factors are occasionally honored, good job performance will always be rewarded (Quick, 1980:59).

Job Descriptions

Overview

Job descriptions fill many roles for an organization. They serve as the basic building blocks of the organization and the foundation for many human resources programs (Grant, 1988: 45). Job descriptions include each task and responsibility necessary for the entire organization to function efficiently. All these tasks relate to meeting the organizations objectives, so theoretically, if every employee follows his or her job description, all objectives would be met (DeLapa, 1989:156). Viewed in this way, the important relationship between the job description and an organization's mission is clearly evident. The following section provides an brief summary of the job description and its relationship to job motivation and performance

Job Description Summary

A job description is a principal product of job analysis. According to Ghorpade, the "distinguishing characteristic of a job description is that it provides a picture of the

what, *why*, *how*, and *where* of the job in capsule form" (Ghorpade, 1988,94). Table 2 presents a summary of the items that can be included in a job description:

TABLE 2 CONTENTS OF JOB DESCRIPTIONS (Ghorpade, 1988:96)

Job Identification	Title, subtitles, codes, grades, wage classifications, location, and reporting relationships
Job Summary:	
Mission	Concise but complete statement of the mission or purpose of the job and the products or services expected of the worker.
MTEWA	Machines, tools, equipment, and work aids
Materials	Raw materials, goods in process, substances, data, and other materials used in the work.
Techniques and Methods	Characteristic ways of transforming resources into outputs.
Guidelines and Controls	Modes of supervision and prescriptions relating to quantity and quality of output, techniques and methods, behaviors, and work sequence.
Tasks/Behaviors	Description of work performed, inclusive of interactions of the worker with data, people, things, and guidelines under which the work is done.
Context	Physical, psychological, and emotional context of the job, terms and conditions of employment; and interrelations with other job.
Supplementary Information	Details not accommodated in the above sections, but that are essential or useful for operational purposes; definition of terms.

Job descriptions provide many uses for managers and supervisor in directing employee activity and in evaluating their performance. Supervisors can use job descriptions as a basis for assigning work, clarifying missions, and performance expectations, and monitoring individual performance (Ghorpade, 1988, 96). Job

descriptions are a primary tool in performance appraisals. Their major use in this case is the formulation of performance criteria and standards. Descriptions are also serve as the basis for understanding the critical human behaviors involved in job performance (Ghorpade, 1988:96).

There are two universal concerns of job descriptions: job identification and job summary. Four types of materials can be included under the section of identification: job title, other identifying labels (i.e. specialty codes [AFSCs], grades, subtitles, etc.), location of the job, and reporting relationship. The job summary provides and overview of the job as an organizational unit. A minimal expectation is that the summary state, as clearly as possible, the mission or basic purpose of the job. The summary are linked with its system of functional job analysis. They convey the *what and why* of jobs within the data, people, and things framework (McCormick, 1979: 63).

All job descriptions contain some description of the tasks involved. A task is a grouping of activities that are targeted at producing identifiable outputs (Ghorpade, 1988:102). To provide a logical organization for evaluating duties and responsibilities, tasks are grouped into task areas. Buford et al, define a task area as a "collection of duties that, when taken together, identify a primary reason for the existence of the job" (Buford et al, 1988:132). Expressed in the language of job analysis, the who, what, why, and how of tasks take the following forms:

Who The performer of tasks is assumed to be the worker

What This refers to the activities involved in the task, which maybe physical, mental, or interpersonal

Why This refers to the outputs that take the form of products or services. Outputs of tasks, however, are not synonymous with the outputs of jobs. Rather, task outputs are a stage of production of job outputs; they serve as inputs in the making of products or services with which the job is identified

How This refers to the method and procedures used to carry out the job. In the case of physical activities, this encompasses MTEWA, materials, techniques, and methods and guidelines and controls used to execute certain physical responses. In the case of mental activity, this may involved the use of calculations or formulas, the exercise of judgment, or the selection and transmittal of thought
(Ghorpade, 1988:103, McCormick, 1979:62-63)

Task descriptions are intended to communicate the dynamic aspects the job. It is important that they be written in explicit terms. The following is a compilation of rules that have been accumulated in regard to writing descriptions:

- A terse, direct style should be used (McCormick, 1970:64)
- The present tense should be used throughout.
- Ever task statement should begin with an active verb.
- Specific verbs are preferred over those that describe broad process, job functions, or accountabilities. Examples of verbs that should be voided are assure, determine, indicate, ensure and supervise (Gael, 1983:57).
- Only one action and one object should be included in a task statement.
- Use quantitative work where possible. Rather than saying "pushes loaded trucks," write "pushes hand truck loaded with 100 to 500 pounds of steel plate" (Grego & Rudnik, 1970:10)
- Tasks should be described in language that is familiar to the job incumbents. Technical terms, acronyms, and other specialized or uncommon terms should be singled out and underlined; they should then be defined or explained with liberal use of examples and applications in the supplementary section of the description (Gael, 1983: 51)
- The description of tasks should reflect the assigned work performed and worker traits ratings (McCormick, 1979: 64)

The purpose of the job description is to supply a written document that tells what is done on the job, how it is done, and why it is done. The words used to convey this information have to be concise and focused on providing a thorough encapsulation of all relevant material.

Linkage to Performance

While its importance is often overlooked in addressing causes to performance problems, the job description provides and excellent place in which to concentrate efforts to eliminate the occurrence and recurrence of problems. Job descriptions can help by

providing a written explanation of the composition of the job as well as being the basis for the criteria and standards for performance appraisals. Job descriptions establish a rational link between job content and performance (Buford et al, 1988:132).

As described in the overview, the job is divided into a collection of tasks areas. Evaluating each of the tasks area in relationship to its importance to the overall mission allows managers to appraise performance. Because each task area is part of the whole job, not carrying it out or performing the duties poorly will eventually impact on the final results. Therefore, the description serves a basis for evaluating the performance of an employee.

Buford et al suggest that each task area be introduced by a flag statement that describes the types of behaviors and outcomes that identify successful job performance. (Buford et al, 1988:132). The task areas should be presented in order of importance, and each allocated a percentage so the summation of all task areas is 100%.

In addition to stating task importance, these flag statements are the basis for the performance criteria that an employee should be evaluated against. The job descriptions allow a manager to evaluate performance throughout the performance period. By periodically reviewing an employee's duties and responsibilities, the supervisor can praise those behaviors that warrant praise (DeLapa, 1989:157). Ongoing performance management allows the supervisor to anticipate problems and intervene before they escalate out of control (DeLapa, 1989:157). The supervisor discusses acceptable performance standards with the employee. Together, they develop a plan for making necessary improvements and set a time for a follow-up evaluation.

Linkage to Motivation

Job descriptions are powerful tools for influencing employees' choices. First, the description clarifies the company's expectations its workers. Writing out what the

workers are expected to do or accomplish allows the job description to serve as a reference guide to move employees in the correct work-related direction (Grant, 1988:47)

Job descriptions also explain what each worker must do to perform a job successfully. They defines the importance and time requirements of a worker's effort (Grant, 1988:47). The job descriptions prescribes the desired amount of effort as well as provide direction for that effort.

Along with providing information on job effort, the job description gives insight into sources of intrinsic job satisfaction and into behaviors that carry high outcomes of negative consequences (Kent, 1986:83). Job descriptions that provide the intrinsic insight allow managers to exploit the rewards of certain tasks and address problems associated with tasks lacking satisfaction (Grant, 1988: 47). Job descriptions also allow managers the opportunity to find out which jobs their employees find demotivational due to negative outcomes. Redesigning these tasks to lower the associated negative outcomes allows management to increase the employee's motivation (Grant, 1988: 47).

Performance Analysis

Overview

Solutions to problems are like keys in locks;
they don't work if they don't fit.
And if solutions aren't the right ones,
the problem doesn't get solved. (Mager, v)

When addressing causes of recurring problems, people often fall into the trap of correcting the symptoms instead of the actual cause of the problems. This is especially true in the environmental world. After reviewing the ECAMP action plans submitted by ACC bases from 1991 to 1993, HQ ACC/CEV found that the base environmental flights were fixing symptoms instead of causes (Pare', 1994:126). For instance, Base X had 15 findings for improperly labeled drums of hazardous waste. To "solve" the problem, the base correctly labeled the drums identified in the ECAMP report. The next year, the same

findings were discovered. This scenario indicates the two errors that this approach yields. The first is that a "solution" has been found without adequate examination of the problem. The other is that the real or root cause(s) of the problem may not have been identified. There are unanswered questions that hint at deeper, underlying problems that caused the violations like, Why wasn't the drum labeled? Were the drums overlooked? Whose responsibility was it to ensure that all drums in the storage area are labeled? Is this a one time occurrence or is this a recurring problem? Are the personnel trained properly in all the procedures? Does everyone have access to the procedures? The answers to these questions and other questions like them will lead to the finding the root cause of the problems and eliminating them. But how can managers find the answers to these questions? One way is to conduct a performance analysis.

Dr. Thomas Gilbert, a leader in the field of analyzing human performance problems, states that the primary goal of a performance analysis is "troubleshooting . . .the discovery of the most important opportunities for improving competence." (Gilbert, 1978:45) The objectives of a performance analysis are to determine the following:

1. Precisely what the "problem" is
2. What the parameters of the problem are
3. The priority of solving the problem
4. The probable cause of the problem
5. The solution to the problem

(Rummler, 1976:18, Zemke, 1992: 218-220)

Performing this type of analysis provides several advantages to the managers. It 1) links knowledge and skills requirements to job performance, 2) validates or evaluates the job requirements, 3) establishes the impacts of job outputs and prioritizes knowledge and skill inputs, and 4) addresses other factors affecting performance. (Craig, 1987:231)

Techniques

There are several human performance problem techniques and procedures that are used to help determine causes of "problems". Zemke refers to these as Figuring Things

Out (FTO) techniques (Zemke, 1992:5). These techniques are the bases for the majority of the performance analysis models in existence. Some are based on the direct observation of the performer at work (simple observation, time-and-motion studies, task listings, behavioral frequency counts); some are based on discussion with people about work (focus groups, interviews, questionnaires, surveys). Others are based on using instruments to derive information from behavior or to troubleshoot (critical incidents, consensus groups, hierarchy of learning). The model developed in this thesis effort derives from a basic observational technique: the algorithm.

In tasks that are highly decisional in nature and have fairly simple operations and procedures, the algorithm method is the analysis technique of choice. An algorithm is a sequence of operations and decisions for solving a problem or performing a task. (Zemke, 1992:53) The algorithm has also been described as a decision-making flow chart of the processes, operations, and decisions it takes to do a task. (Kent, 1986:2) The concept comes from various scientific disciplines, particularly the area of human problem solving (Kent, 1986:2). Ivan Horabin, a training consultant, defines the algorithm concept as:

> An orderly procedure or exact prescription for solving a problem. An algorithm leads the user from a collection of input data to a desired result. Strictly speaking, all rules and regulations are algorithms. But in this context (training), we limit the use of the term algorithm to presentation of rules and regulations in specific forms. In this sense, an algorithm is usually a decision tree and always a presentation in which the physical layout shows the relationships between inputs, data and outcomes. The algorithm replaces continuos prose as an instrument for communicating complex rules and regulations. (Zemke, 1992:47)

Algorithm analysis is a way of capturing rule-oriented, sequential data. The process/decision flow chart, or algorithm approach, is useful in analyzing and organizing the elements of jobs composed of decisional tasks (Zemke, 1992:53). Kent notes that most individuals commonly use "flow charts in their minds" (developed through years of experience) to help them make decisions (Kent, 1986:2). In most cases, the algorithm that the analyst is trying to develop is merely and efficient way of capturing the decisions,

discriminations, operations, processes, procedures, and knowledge pieces to solve a particular problem (Zemke, 1992:53). The flow chart method breaks most decisions into questions that have simple yes/no answers followed by equally simple operations. An advantage of an algorithm is that it is neither right nor wrong; it's a reflection of the way a particular "culture" has decided to solve a specific problem. Another advantage of the algorithm is that a person doesn't have to know all the relevant theories and applications of the problem; he/she can solve the problem by following the logical flow of the events. Kent uses the following example from a New York state and city income tax form to illustrate this point:

> You must file a return if you are required to file a federal return and even though you may not be required to file a federal return, you must nevertheless file a New York return if you meet any one of the following three conditions . . . . (Kent, 1986:2)

The instructions usually confuses the average person in a hurry. However, using an algorithm, the verbal maze can be handled very quickly. Figure 7, on the following page, provides an example of how an algorithm can simplify confusing instructions.

In addition to there being a large number of techniques and procedures used to find causes to performance problems, there are a number of models and theories concerning the subject. These can be broken down into the following basic kinds: behavior-modification, social learning (behavioral modeling), transactional-analysis, cognitive, and problem solving (Zemke, 1992:21).

The bases for the performance model developed in this paper uses the concepts of a problem solving analysis first introduced in 1970 by Drs. Robert Mager and Peter Pipe. This model has served as the foundation for the majority of the models and theories concerning human performance problem analysis.

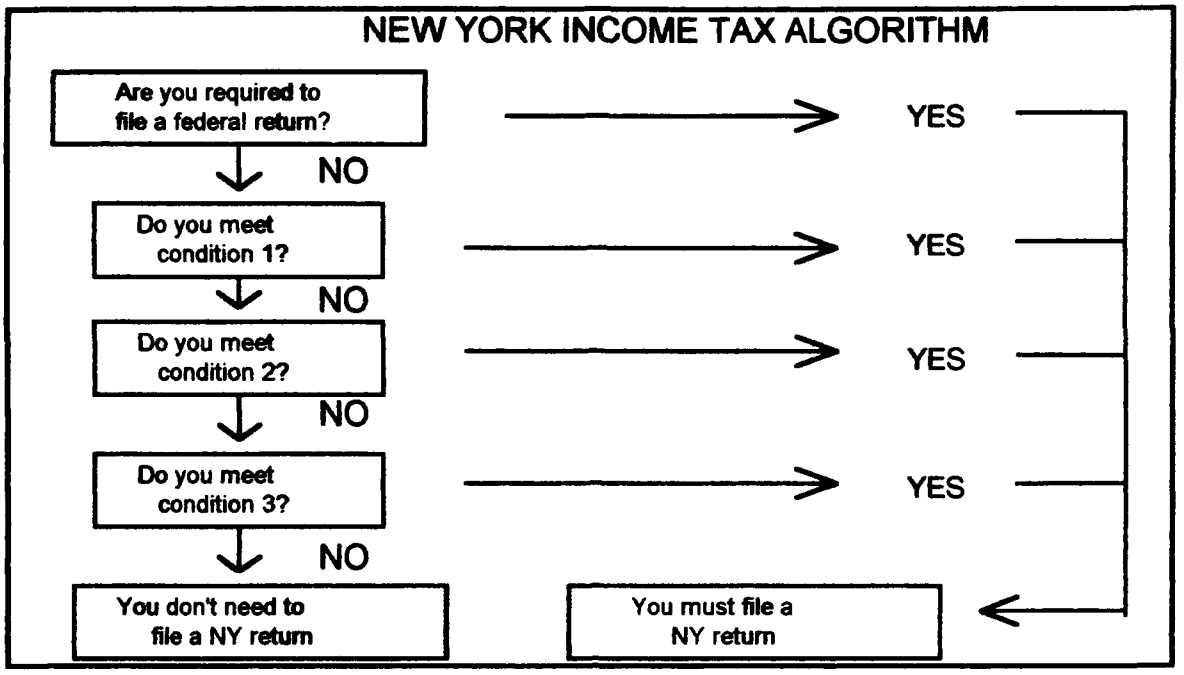

Figure 7 Example of New York Income Tax Algorithm (Kent, 1986: 3)

The following section details the performance model developed by Mager and Pipe. It has served as the building blocks for which the majority of the human performance models in existence are based, ranging from behavioral based to the problem-solving method (Zemke, 1992:3). The model by these authors is the foundation of the method developed in this theses effort, thus a clear understanding of their concepts is needed.

The Mager and Pipe Performance Model

According to Mager and Pipe, a performance analysis is a procedure to "analyze the nature, the importance, and the cause of things called *performance discrepancies.*" (Mager and Pipe, 1970:7). A performance discrepancy is described as the difference between someone's *actual* performance and his *desired* performance (Mager and Pipe, 1970:7). A number of the problems that we assume are training problems in the environmental realm are actually performance discrepancies, such as the previously mentioned non labeling of hazardous waste drums. In fact, 90 percent of the time, when we hear someone say that training is the solution to employees performing poorly, training

is at best only part of the answer (Carr, 1993:51). Usually when you hear statements like "We've got a training problem," or "They could do it if they wanted to," what you actually have is a performance discrepancy. (Mager and Pipe, 1970:9) Each of these statements is only a symptom of a discrepancy, not a description. The first step to eliminating a performance deficiency is to understand its nature. To do this, Mager and Pipe write that a manager must ask questions like, "Why do I say something is not the way it out to be? Why do I say there is a 'training' problem? What event causes me to say that changes must be made?" (Mager and Pipe, 1970:9).

When a manager detects an important performance discrepancy, it must not automatically be classified as a "training problem" and the solution shouldn't not necessarily involve teaching/training. Before a manager can arrive at a solution, he must discover what kind of problem he has. Performance deficiencies can be classified as deficiencies of knowledge, which result from and employee's not knowing what to do, how to do it, or when to do it; or as deficiencies of execution, which result from an employer's failing to perform because of factors in the work environment. (Rummler, 1976:18) Mager and Pipe define this deficiency of knowledge as a "skills deficiency." (Mager and Pipe, 1970:17)

If there is a genuine skill deficiency, then the primary remedy must be either change the employee's skill level (teach him to do it) or change what is required of him. (Mager and Pipe, 1970:17). If, however, he is able to perform but doesn't, the solution lies in something other than in "re-training" him. No amount of information is necessarily going to change this situation. In fact, conducting extended training to solve an "execution" or non training problem waste both money and time (Rummler, 1976:21). The remedy in this case is to change the conditions or the consequences surrounding the desired performance (Mager and Pipe, 1970:20). So, determining whether the employee in question was once able to perform as desired is an important consideration to be made.

Alternative I: A Skill Deficiency Exists. Determining whether a lack of skill is due to forgetting or a lack of training is one of the more important and neglected decisions the analysis of performance discrepancies. (Mager and Pipe, 1970:25) When a skill fades or disappears, an appropriate remedy to consider is a skill maintenance program. Skill maintenance programs come in two major forms. One kind is a systematic honing of an important skill or state of knowledge that has to be used only occasionally. (Mager and Pipe, 1970, 32) An example of this occurs when is a police officer practices firing his/her weapon on a shooting range. The officer normally rarely uses his/her gun on duty but must keep his/her accuracy within acceptable limits in case the weapon ever has to be used. The other type of situation in which a skills maintenance program is needed involves practice with feedback. Any time performance is something other than what is desired and there is reason to believe that the desired performance could be within the person's capabilities, the supervisor should check to see whether that person is receiving regular information about the quality of his performance. (Mager and Pipe, 1970:33) Many times an employee performs a task regularly; however, the technique he employs isn't correct. If he has no way of knowing how well he is doing (receives no feedback), the practice merely compounds the improper actions and hurts the overall performance.

So, if an employee performs a task regularly, but the results are not up to standards, the manager should investigate the possibility of a lack of feedback as the probable cause. If, on the other hand, he doesn't perform the task regularly, look for the lack of practice as a probable cause.

The circumstance that hasn't been discussed is if the employee has never been able to accomplish a task. In this case, formal training is the desired remedy.

As with other causes of performance deficiencies, one of the possible remedies is to change or simplify the job, to modify the performance that is required or expected. (Mager and Pipe, 1970:34). In addition to, or instead of, trying to upgrade someone's performance, even if that performance once existed, the manager can sometimes solve the

problem by providing help. (Mager and Pipe, 1970:34). By asking the following questions for each situation involving definite skills deficiencies, the problem can be more clearly defined:

1. Is there a simpler way?
2. Does the employee have the potential to benefit from this solution.

(Mager and Pipe, 1970:37)

There is one universal alternative that may be simpler and less expensive than formal training or skill maintenance programs -- changing the skill requirements to meet skills available. (Mager and Pipe, 1970:37) For instance, if, instead of requiring an employee to remember a sequence of steps or rules, the manager provides him with a checklist to which he can refer whenever it is needed, the manager has simplified the job. There are many common examples of tasks that have been made easier and have eliminated the need for formal training by using checklists, instructions, or aids. Many household appliances, for example, require some knowledge before use. People do not have to go to a training course to use these appliances; the manufacturer encloses general directions that usually suffice.

The more complex the job, or the more critical it is that it be performed correctly, the stronger the argument for introducing a performance aid rather than expecting people to be "fully trained." (Mager and Pipe, 1970:39). If you have a task that is performed infrequently and which is also both complex and critical, the manager has every reason to find ways of reducing the need for such human skills as recall and judgment. (Mager and Pipe, 1970:39). A good example occurs due to transient aircraft at flying bases. The base spill team routinely practices how to "handle" spills from the "home" aircraft. However, because there are so many different kinds of transient aircraft that could potentially come into the base, the members of the spill team are not required to recall from memory all the nuances of those aircraft. Instead, the team members are given checklists and memory aids to assist in the case a response to a spill from a transient aircraft is necessary.

In addition to using checklists, industry has found that errors can be eliminated by labeling the controls of equipment. (Mager and Pipe, 1970:39) Color coding can reduce errors and the need for training. For example, color coded pathways on warehouse floors tell forklift operators where to travel and where to travel and where to store what; color coded gas tanks tell the anesthesiologist their content; gas pumps at the service station are color coded for easier recognition; and price tags in the dress shop are often color coded according to dress size. (Mager and Pipe, 1970:39)

In summary, even when a genuine skill deficiency exists, any solution to the problem should be weighed against the possibility of changing the job, particularly through providing some kind of job aid--checklists, instruction sheets, signs, label; color coding, etc. (Mager and Pipe, 1970:41). If training seems to be the only remedy, on-the-job training may be easier and cheaper and just as formal training (Mager and Pipe, 1970:41).

Alternative II: It Is Not A Skills Deficiency. When a manager knows or suspects that an employee could perform if he really had to, usually something other than instruction is needed. In general, the remedy is that of *performance management* (Mager and Pipe, 1970:47). Rather than modify the person's skill or knowledge (since it's likely that he already has the ability), the manager will have to modify the conditions associated with the performance, or consequence or result of that performance (Mager and Pipe, 1970:47). In other words, instead of changing what the employee can do, change something about the environment in which he does it in so that doing it will be more attractive, and/or less difficult.

The following four general cases cause the nonperformance:

1. It is punishing to perform as desired.
2. It is rewarding to perform other than as desired.
3. It simply doesn't matter whether performance is as desired.
4. There are obstacles to performing as desired.

(Mager and Pipe, 1970:48)

When dealing with the lack of performance for reasons other that skill deficiency, the manager should consider all of these cases before completing a performance management analysis.

It Is Punishing to Perform as Desired. One reason that people don't do as they are expected to do is simply that the desired "doing" is punishing (Mager and Pipe, 1970:51). And when desired performance leads to undesirable results, people have a way of finding other ways to go. If someone feels he will be punished, or even that there is a risk of being punished when he performs as the manager desires, he will avoid doing it that way whenever he can. So, when an employee is not performing as the manager knows that he/she can, one option the manager should explore is if that employee perceives that he/she will incur some unpleasant results. A common example occurs at the beginning of many staff meetings. Time is wasted waiting on people who arrive late. What is the consequence of being on time? Punctuality is punished and tardiness is rewarded. The meeting starts when the latecomers arrive, hence more people come late. Another example is the case of a conscientious performer who scrimps and saves to underspend the yearly budget by 10 percent and save the company money. The next year the budget allotted is cut by 10 percent. The good performance has been rewarded with a negative consequence.

Once a problem of this kind is identified, the manager will have to find a way to reduce the perception that the desired performance will be punished and create or increase the likelihood of a positive consequence. The employees have to see that their efforts will be rewarded. Kent notes that some companies provide bonuses or recognition to departments that with positive performances while others may tie desired privileges and incentives to sustained performance efforts over an extended period of time (Kent: 1986, 84).

It is Rewarding to Perform Other Than as Desired Another side to the issue of performance being punished is when non-performance is rewarded. In other words, whether or not a desired performance has favorable consequences, they are not as favorable as those of an other-than-desired performance. A common example involves the employee who sloughs along, doesn't work hard and doesn't get the job done. What happens? The boss intervenes and takes work away from him, theorizing that the employee can't handle the task and needs an easier one. Subtly, the employee's poor work is rewarded--he gets fewer assignments and easier work. Another example involves children who do not like to accomplish certain tasks. A parent will ask the child to perform a task that the child doesn't want to do. The child complains incessantly and finds ways to stall to keep from performing. The parent finally gets tired of badgering and listening to the complaining and does the task. Ultimately, the child has been rewarded for non-performance because he/she gets what he/she wanted in the first place--to avoid performing the task.. For those children who thrive on attention, they find that they get it more when they misbehave than when they behave as expected.

The way to combat non-performance is to get rid of inappropriate reinforcers. For the above example, when the child complains to avoid performing the task, the parent should not reward the behavior by doing it for them. He should make the consequences of performing the task more appealing that not performing or make the consequences of not performing infinitely more unpleasant than performing the task.

It Simply Doesn't Matter Whether Performance Is as Desired.

Sometimes a performance discrepancy continues to exist neither because the performer doesn't know how to perform nor because he isn't motivated, but because it simply doesn't matter whether or not he performs (Mager and Pipe, 1970: 71). There are no positive or negative consequences associated with doing the job. When a performance is not followed periodically with an event considered to be favorable (i.e., praise or recognition),

that performance probably will not be continued. Kent refers to this as "extinguishing good behavior" (Kent, 1986: 89)

Because good behavior can unknowingly be "extinguished", it is critical that performance feedback be given throughout the year and not just during the annual performance appraisal. the manager should let his/her employees know that how they are doing during good and bad periods. Also, the manager needs to let his employees know periodically that their good performance is noted and appreciated and that bad performance will not be tolerated. This keeps the good behavior from being extinguished.

There Are Obstacles to Performing as Desired. If it looks as though a person knows how to perform but doesn't perform, the manager should look for obstacles. He should look for things that might be getting in the way of his the employee performing as desired. Some of the that can be obstacles to performance are the lack of tools, poorly placed or poorly labeled equipment, bad lighting, or uncomfortable surroundings. Distractions such as the telephone, noise or lack of it, other employees, too much interoffice activity, etc. are another form of obstacles that a manager should explore. Another common obstacle that will keep even the best employees from performing well is personal crises that occur outside of work (sick children, financial problems, marital problems, etc.). A manager should keep this in mind when dealing with employees who knows how to perform and doesn't. There is usually a reason that does not include either lack of interest or poor motivation or desire. Most people want to do a good job; however, when they don't, it is often because of an obstacle in the world around them (Mager and Pipe, 1970: 88).

IV. DATA ANALYSIS TO DEFINE "IDENTIFIABLE" TRAITS

This chapter reviews discuss the data obtained from the external ECAMPs of thirty-three ACC bases from FY91-FY93. Once summarized the data will then be correlated with human performance problems. Establishing this correlation will help to confirm the hypothesis that the majority of the negative ECAMP findings are performance-based.

Analysis of Initial Data

To begin this process, an analysis of the ECAMP data obtained from HQ ACC/CEVP was done. The analysis uncovered 437 basic discrepancies in the ten protocol areas: hazardous waste, hazardous materials, POL, special programs, water quality, pesticide management, air, solid waste, natural/cultural resources, and noise management. From this baseline, 2567 occurrences were found (an occurrence refers to a finding that has been cited numerous time at one base or a group of bases). Table 3 summarizes the information gathered from the thirty-three ECAMP reports.

TABLE 3 ECAMP FINDINGS BY PROTOCOLS

PROTOCOL	OCCURRENCES	FINDINGS
Hazardous Waste	527	89
Hazardous Materials	583	50
POL	330	40
Special Programs	239	40
Water Quality	225	55
Pesticide Management	210	34
Air Quality	162	53
Solid Waste	137	35
Natural/Cultural Resources	123	32
Noise Management	31	9
TOTALS	**2567**	**437**

Frequently Documented Findings

The following section will provide a brief synopsis of the problems most frequently documented in each protocol area. This will help to show that performance problems are closely related to the majority of the ECAMP findings. The total listing of all ECAMP findings from the three year period are located in Appendix A.

Hazardous Waste. These protocol area accounts for the largest number of findings and the second largest amount of occurrences. The most common deficiencies are in labeling and lack of start dates at accumulation sites. Improper releases and discharges of hazardous wastes received the second highest number of documented findings.

Hazardous Materials. The largest discrepancy in this area is the improper storage of hazardous materials, due to gas cylinders and flammable items not properly stored and incompatibles hazardous materials being stored together. Another finding was due to the lack of safety equipment being used or worn (i.e. eyewashes, fire extinguishers, safety goggles, aprons, gloves, etc.). Lack of signs and warnings placed third on the list of prevalent findings.

POL. This protocol represents the third largest category of ECAMP findings. The greatest number of violations are in the area of underground storage tanks. They primarily center around not registering tanks, improper abandonment and closure procedures, and lack of tank certification. The second largest area of findings is for spills and unpermited discharges.

Special Programs. The majority of the problems in this area are in PCB management. A great portion arise from inadequate storage, inadequate labeling of PCB items and storage areas, and inadequate documentation of PCB activity. Asbestos programs have received a large number of findings also. Most of the violations in this area are the result of inadequate notification to the state for asbestos removal projects, lack of

certification for asbestos removal teams, and the failure to use adequate procedures for asbestos abatement.

Water Quality. The majority of violations in this area occur due to exceeding NPDES permit limitations and various problems associated with wastewater treatment plant. Also, inadequate oil/water separator management led to a large number of findings. The drinking water findings are due to the lack of sampling or exceeding the maximum allowable contaminants in the drinking water.

Pesticide Management. The major findings in this protocol involved the lack of proper storage facilities for pesticides. Covered storage for pesticide application equipment accounted for the largest discrepancies.

Air Quality. The findings in this protocol were due to permit inadequacies. The most prominent problem was the lack of air permits for air emission sources. The other discrepancies occurred because of operational violations of these permits--personnel did *not follow state air regulations*

Solid Waste. The largest discrepancies in this protocol were the lack of permits for dumping solid waste on land and creating construction debris landfills. Like the air protocol, this area is weighed heavily by state regulations, so, a number of operational violations occurred.

Natural/Cultural Resources. The majority of findings in this area are due to the lack of plans and cooperative agreements.

Noise Management. The majority of findings relate to outdated Air Installation Compatibility Use Zone (AICUZ) studies.

Analysis of Performance-Type Problems

After the initial analysis of the findings and reviewing the summary of discrepancies, a trend starts to become apparent. The majority of the problems are a form of human performance problem. Applying the explanation of performance problems in

Chapter III (a difference between someone's actual performance and his desired performance) to the type of findings discovered in the ACC data base led to the belief that a method for finding the "inherent root causes" of ECAMP problems could be developed using a performance analysis model.

Another analysis of the data was accomplished, this time using the ACC Root Cause Analysis in Appendix B as a guide . Using the classifications that were compatible to performance problems (training, management and oversight, and planning and guidance), the findings were identified and placed into one of the categories (or a combination of the categories such as training/management for those that fell into two categories). Those findings that fell into both performance and non-performance categories were not included. The following table gives a summary of the results. The actual numbers can be found in Appendices C and D.

TABLE 4 PERFORMANCE -TYPE ECAMP FINDINGS (FY91-FY93)

PROTOCOL	OCCURRENCES	FINDINGS
HAZARDOUS WASTE	447/527 (84.8%)	75/89 (84.3%)
HAZARDOUS MATERIALS	498/583 (85.4%)	43/50 (86.0%)
POL	186/330 (56.4%)	21/40 (52.5%)
SPECIAL PROGRAMS	212/239 (88.7%)	37/40 (92.5%)
WATER QUALITY	177/225 (78.6%)	44/55 (80.0%)
PESTICIDES MANAGEMENT	146/210 (69.5%)	27/34 (79.4%)
AIR QUALITY	111/162 (68.5%)	36/53 (67.9%)
SOLID WASTE	116/137 (84.7%)	30/35 (85.7%)
NATURAL/CULTURAL RESOURCES	110/123 (89.4%)	26/32 (81.0%)
NOISE MANAGEMENT	23/31 (74.2%)	6/9 (66.7%)
TOTALS	2026/2567 (78.9%)	345/437 (79.0%)

The data reveals that 78.9 percent of all the ECAMP occurrences were performance based. This corresponds well to the performance problems involving the findings (79%). These findings compare well to the literature findings. In the early 1980's, the Department of Defense asserted that the vast majority of the violations received were administrative in nature and was proven to be technically correct (Brown, 1993:227). Brown says that the

DoD found that "77 percent of the outstanding violation could have been avoided through better training and improved management . . ." (Brown, 1993:227). These areas of performance based problems still account for close to 80 percent of the ECAMP discrepancies. Thus, if a method to identify causes of performance problems is developed, then the Air Force could eliminate the greater majority of its ECAMP discrepancies.

V. DEVELOPMENT OF THE PROPOSED ROOT CAUSE ANALYSIS MODEL

Two elements are used within this thesis to create the proposed root cause analysis and investigate it. These methods are the literature review, in chapter III, and the development process of the proposed method, provided within this chapter. The literature review was conducted to provide the background information necessary to support the design and explanation of the proposed model. The information in the literature review provides the reader a basic understanding of how motivational analysis, job description, and performance analysis are related to performance problems. The development process provides the information needed to understand and apply the model to ECAMP findings.

Model Criteria

Two major concepts influenced the development of the model. One is that it follows the K.I.S.S. principle of management--Keep It Simple Stupid--as well as the Friesen method of studying problems--Keep It Short and Sweet. The techniques used are simple with a logical progression, easy to understand and apply, and do not involve an excess amount of pointless analysis. The other influencing is known as the "onion-skin approach to problem diagnosis." Kent explains this approach with the following description:

> If an onion represents performance problems, each layer represents a probable cause. The layers on the outside represent the common and simple causes with the easiest resolutions. The layers at the core of the onion represent the more complex and less common causes. The deeper problems aren't easy to solve.
>
> In order to discover the cause of a problem we should peel away one layer at a time. It's more efficient and often more correct to avoid jumping to conclusions by burrowing right to the core. If you're in the habit of looking deep into the "onion" as soon as you detect a performance problem, you're presuming the problem is deep-seated, for example, a psychological problem of motivation or attitude. . . .
>
> Rather than presuming the problem is at the center of the onion, start at the outer layer and strip away one layer at a time. It lets you avoid the common mistake of making more of a performance

> problem than it really is. By assessing the simplest causes first, you often solve the problem sooner. (Kent: 1986: 6)

By solving the problem a "layer" at a time, the model does not presume or falsely conclude the cause of a problem. For instance, using the example of the non-labeling of hazardous waste drums. The model does not allow anyone to presume that the root cause is lack of training and then try to find reasons or causes to match that conclusion. Instead, the discrepancy is the point of reference, the starting point, without regard to a preconceived cause. The model then provides a progression of steps to determine the real cause of the problem, delving deeper and deeper with each step.

Explanation of Proposed Model

The model is an eight step approach to analyzing a performance discrepancy. The questions presented in the following section correspond to the flow chart found at the end of the section. Each phase of the model is preceded by a general question with more probing questions following. The purpose is to obtain a deeper understanding of the performance discrepancy by answering a series of questions about the problem

Step 1: What is the performance discrepancy?

In this model, the performance discrepancy comes from the ECAMP report. The findings from the report, such as improper storage of compressed gas cylinders or contingency plans not reviewed/updated give the manager a definite place to begin the analysis. To get a broader understanding of the discrepancy and further evaluate the problem at hand, the following questions can be asked:

- What is the difference between what is being done and what is supposed to be done?
- What is the event that causes me to say that things aren't right?
- Why am I dissatisfied?

Step 2: Are the job performance expectations known?

There are two sources to examine to determine the answer to this question. One is to ask the employee(s) to see if the job expectations are understood. The other is to look

at the job description. If the expectations are written and the employee doesn't understand them, then a meeting should be held between the manager and employee to clear up any misunderstanding. If the expectations are not clearly stated, then the job description should be revised to include them. To obtain a better perspective on the expectations of a job, ask questions like the following:

- What are the job standards?
- Who verified these standards?
- What are the tasks performed during the job?
- What is the frequency with which the tasks are performed?
- What is the relative difficulty of each task as compared with the rest of the tasks on the job?
- Are there additional tasks customary to all workers on the job?
- What methods or processes are used to accomplish the tasks of the job?
- What materials and equipment are used to accomplish the tasks of the job?

Step 3: Does the employee recognize the importance of the job/task/behavior?

Check to see if the employee understands the job priorities and the importance of the task. Again, the simplest way to find an answer to this question is to ask the employee. If the employee doesn't realize the importance, the manager should provide feedback to establish a priority of tasks. A manager can ask the following type of questions to determine the importance an employee places on certain tasks, jobs, or behaviors:

- Is the employee aware of the role he/she is supposed to play in the position held?
- Is the employee putting emphasis on the wrong parts of his/her work?
- If the employee has a choice between or more activities, does he know the priorities place on each item?
- Does the employee have a good sense of job priorities, but not of the importance of the task?

Step 4: Is it a skill deficiency?

To determine whether the discrepancy is due to a genuine skill deficiency, the manager can check the employee's personnel record. This will give the manger an idea of the level to expect from the employee. The record should show any training that has been accomplished, if the employee has had any documented problems performing specific tasks, etc. A records search should not be considered the end-all, however, because everything does not documented. It does provide a good starting point for establishing trends. In addition to a records search, talking with the employee, his co-workers, and former supervisors will provide valuable information. Questions to ask include:

- Could the employee accomplish the task if he/she really had to?
- Could the employee accomplish the task if his/her life depended on it?
- Are the employee's present skills adequate for the desired performance?

If the deficiency is a genuine skill deficiency, follow the additional proceeding steps:

Step 4A: Could the employee perform the task in the past?

Determine whether the skill once existed. Ask these questions:

- Did the person once know how to perform as desired?
- Has he/she forgotten how to do what I want him/her to do?

Step 5A: Is the skill used often?

Determine whether the lost or deteriorated skill is used frequently or infrequently. If the skill is used frequently but has deteriorated despite regular use, maintain the level of performance by providing periodic feedback. If the skill is used infrequently, maintain the level of performance by providing a regular schedule of practice. To analyze this step further, ask these questions:

- How often is the skill or performance used?
- Does the employee get regular feedback about how well he/she performs?
- Exactly how does the employee find out how well he/she is doing?

Step 6A: Is there a simpler solution?

Determine if there is a solution simpler than performance maintenance or formal training. Ask these questions to get a better idea:

- Can I change the job by providing some kind of job aid?
- Can I store the needed information some way (written instructions, checklists) other than in someone's head?
- Can I show rather than train?
- Would informal (on-the-job) training be sufficient?

Step 7A: Does the employee have what it takes?

Determine whether the employee has the potential to perform as desired. Questions to ask include:

- Could the employee learn the job?
- Does the employee have the physical and mental potential to perform as desired?
- Is the employee over-qualified for the job?

If the deficiency is not the result of a skill deficiency (is a deficiency of execution rather than knowledge), then looking at personnel records will not provide much information. Deficiency that result from lack of execution require the manager to observe and interview to help to identify the problem. Observing the workers environment and the situations surrounding the problem will provide invaluable information. In addition, talking with the employee about his perceptions of the situation will lead the manager in the right direction toward identify the causes of problems. The following steps will assist managers in determining problems related to employee motives and motivation:

Step 4B: Is the desired performance punishing?

Determine whether the desired performance leads to unfavorable consequences by asking some of the following questions:

- What is the consequence of performing as desired?
- Is it punishing to perform as expected?
- Does the *employee* perceive the desired performance as being geared to penalties?

- Would the employee's world become a little dimmer (to him/her) if he/she performed as desired?

Step 5B: Is non-performance rewarding?

Determine whether non-performance or other performance leads to more favorable consequences than would desired performance. Asking similar type questions as the following will help to understand the problem:

- What is the result of doing it the way employees way instead of the manager's way
- What does the employee get out of his present performance in the way of reward, prestige, status?
- Does the employee get more attention for *mis*behaving than for behaving?
- What event in the world *supports* (rewards) the employee present way of doing things? (Is the manager inadvertently rewarding irrelevant behavior while overlooking the crucial behaviors?)
- Is the employee "mental inadequate," so that the less he/she does the less he/she has to worry about?
- Is he/she physically inadequate, so that he gets less tired if he does less?

Step 6B: Does performing really matter?

Determine whether there is a meaningful consequence for the desired performance by asking:

- Does performing as desired matter to the employee?
- Is there a favorable outcome for performing?
- Is there an undesirable outcome for performing?
- Is there a source of satisfaction for performing?
- Is the employee able to take pride in his/her performance, as an individual or as member of a group?
- Does the employee get satisfaction of his/her needs from the job?

Step 7B: Are there obstacles to performing?

Determine whether there are obstacles preventing the desired performance by asking:

- What prevents the employee from performing?
- Are there conflicting demands on his time?
- Does the employee lack the authority? the time?

- Is the employee restricted by policies or by a "right way of doing it" or "way we've always done it" that ought to be changed?
- Can the manager reduce interference by improving lighting?
  - . . . the time?
  - . . . increasing comfort?
  - . . . modifying the work positions?
  - . . . reducing visual or auditory distractions?
- Can the manager reduce "competition from the job"--phone calls, "brush fires," demands of less important but more immediate problems?

Step 8: Which solution is best?

In applying each step of the model, a number of causes will be exposed. Some of the problems identified will readily lend themselves to solutions. For instance, if a contingency plan for hazardous waste has not been completed by a certain date and it is found that the employee did not understand the importance of getting it completed, regular feedback between the manager and the employee could be the answer. Or in the case when lack of knowledge has been identified as the cause of a problem, the solution may be to send the employee for formal training. What happens, however, if the formal training is expensive and the employee has a limited amount of time left on the base. Is formal training still an appropriate solution?. Or can on the job training suffice to teach the employee the skills necessary? Answering questions like that and provided appropriate solution to the causes of problems is the goal of this step. In essence, the goal is to compare the size of the remedy with size of the discrepancy to apply pertinent solutions. These can be done by looking into the following questions:

- Are any solutions inappropriate or impossible to implement?
- Are any solutions plainly beyond the organization's resources?
- What would it cost to go ahead with the solution?
- Is it worth doing?
- Which remedy is likely to give the organization the most result for the least effort?
- Which remedy is the organization best equipped to try?
- Which remedy is most visible to those who must be pleased

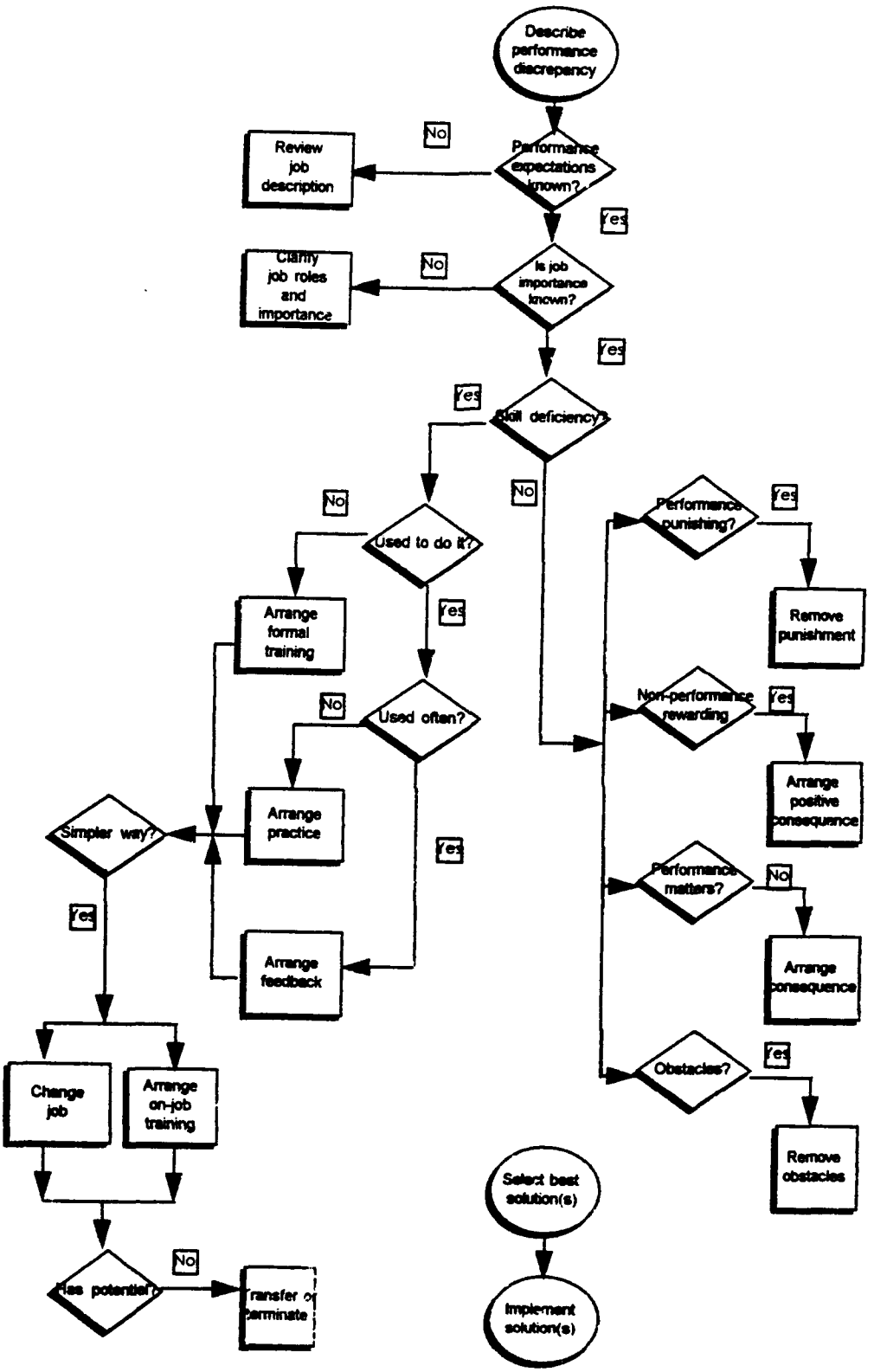

Figure 8 Proposed Root Cause Analysis Model

Evaluation

The proposed method has two things that need to be taken into consideration. One is that most problems or discrepancies are multi-causal. Because of this fact, the manager should continue through the entire flow chart when analyzing a performance problem. If the manager finds an appropriate cause in the middle of the flow chart and does not continue with his analysis, he may miss the opportunity to find another cause that can benefit him even more in his quest to understand and identify a cause of a problem.

The second item of concern is that it needs to be understood that this process is one for identifying performance problems. It does not concern itself with those items that an employee has no direct control over (i.e., funds or manpower problems to use a non-performance standard from the ACC analysis). It also will not help the manager to understand everything about why employees behave as they do. It does, however, help to focus efforts on identifying the nature of certain types of human performance problems. By doing this, the manager is able to direct his energy toward evaluating a smaller range of problem solutions and dealing with puzzle piece by pieces instead of trying to complete it all at once.

VI. Results and Recommendations

Overview

Chapter VI reviews the research problem and objectives, summarizing the results achieved by the four objectives. The research shows that the analysis method for identifying root causes for performance problems can be used directly to combat the majority of the ECAMP findings. The chapter concludes with a recommendation that AF environmental managers consider applying the proposed method as a systematic way to understand and eliminate the "root causes" of performance based ECAMP problems that continue to reoccur at AF bases nationwide.

Problem Review

The DoD and Air Force are committed to being leaders in protecting the environment and achieving environmental compliance (DeZell, 1993:119). The Air Force took a proactive stance in 1988 with the implementation of ECAMP. However, both ECAMP findings and NOVs increased by 73 percent between CY90 and CY92. The increasing trend is now starting to show signs of reversing itself. The number of NOVs is lowering at a slow but steady pace. To get from 152 in the first quarter of 1994 to zero, the manipulation of ECAMP findings will have to play a bigger role. ECAMP findings and regulatory action have a direct correlation to one another. By identifying "root causes" to ECAMP findings, environmental managers will be able to correlate these efforts to eliminate their corresponding enforcement action counterparts. To aid the managers in getting to this point, this research effort developed a method that enables managers to use motivational theories, job descriptions processes, and performance analysis techniques to assist environmental personnel in identifying root causes of performance based ECAMP findings.

Results Summary

The proposed ECAMP root cause analysis was a direct result of the research methodology designed to achieve the following objectives:

1. Established a direct relationship between of ECAMP findings and human performance problems.

2. Demonstrated how the combined efforts of motivational theory, job description, and performance analysis could be used to identify "root causes" of performance-based ECAMP findings.

3. Developed a model to identify "root causes" of performance based ECAMP findings.

Objective 1

Research objective 1 was achieved by analyzing the ECAMP findings from the 33 ACC bases to determine which ones were human performance problems. This was accomplished to test the theory that the majority of the ECAMP findings were based on performance discrepancies. The initial classification of performance or non-performance problems was based on the areas of the HQ ACC root cause analysis that corresponded--those areas that could be considered discrepancies in training, management and oversight, and policy and guidance. Out of the 2567 findings, 2026 (79%) could be classified as performance problems. This clearly showed that there was a strong correlation between ECAMP findings and performance problems.

Objective 2

To accomplish this research objective, a literature review was performed. The result of this search was to establish a relationship between job descriptions, motivational theory and application, and performance analysis and causes of performance related problems. Combined with the results of objective one, this objective demonstrated that methods used to identify root causes of performance problems in other arenas could also be used to identify causes of performance based ECAMP findings.

Objective 3

This objective was accomplished by developing the proposed model that incorporated the principles of performance analysis, motivation, and aspects of job analysis into a flow chart. This model provides a step by step process for identifying root causes

involving areas such as training, job descriptions, and work environment and motivation that prevent effective performance.

Recommendations

This thesis outlines a method for determining root causes of performance based ECAMP findings. This technique still needs to be validated by testing it in the field. This could be accomplished as part of a follow-on effort for a future Engineering and Environmental Management thesis. For best results, the student should evaluate a base that is within six months to a year of an ECAMP. The model could then be applied to findings from the prior ECAMP to identify possible "root causes." The results from the new ECAMP would help to determine if the success of the model.

In addition to being used in the Air Force, this research could be used in other branches of the military service. All services have environmental performance problems that plague the effectiveness of their systems. By being able to identify the causes of these problems, they will be able to reap the benefits of this systematic analysis.

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

ACC HAZARDOUS MATERIALS ANALYSIS

	FINDING	#	%	CUMM %
1	IMPROPER STORAGE OF COMPRESSED GAS CYLINDERS	59	10.12	10.12
2	INADEQUATE CONTAINMENT OF HAZARDOUS MATERIAL STORAGE AREA	54	9.26	19.38
3	FLAMMABLE STORAGE CRITERIA NOT MET	51	8.75	28.13
4	IMPROPER STORAGE OF FLAMMABLE/COMBUSTIBLE MATERIALS	47	8.06	36.19
5	IMPROPER STORAGE OF HAZARDOUS MATERIALS	39	6.69	42.88
6	IMPROPERLY LABELED HAZARDOUS MATERIALS CONTAINERS	33	5.66	48.54
7	LACK OF READILY ACCESSIBLE SAFETY EQUIPMENT	28	4.80	53.34
8	IMPROPER STORAGE OF INCOMPATIBLE HAZARDOUS MATERIALS	25	4.29	57.63
9	INADEQUATE MARKING OF HAZARDOUS MATERIALS STORAGE SHED	21	3.60	61.23
10	IMPROPER STORAGE OF ACIDS	20	3.43	64.67
11	LACK OF MSDS FOR HAZARDOUS MATERIALS	19	3.26	67.92
12	LACK OF HAZARDOUS WARNING SIGNS AT COMPRESSED GAS STORAGE	17	2.92	70.84
13	INADEQUATE HAZCOM TRAINING PROGRAM	16	2.74	73.58
14	HAZARDOUS MATERIAL STORAGE AREA CONSTRUCTION STANDARDS NOT MET	15	2.57	76.16
15	IMPROPER HAZARDOUS MATERIALS CONTAINER	14	2.40	78.56
16	LACK OF DRIP PANS	9	1.54	80.10
17	LACKING/INCOMPLETE SPILL RESPONSE EQUIPMENT	7	1.20	81.30
18	INADEQUATE VENTILATION	7	1.20	82.50
19	ACID STORAGE AREA DOES NOT MEET CRITERIA	7	1.20	83.70
20	NO SPILL CONTINGENCY PLAN AT HAZARDOUS MATERIALS STORAGE AREA	6	1.03	84.73
21	IMPROPER GASOLINE CAN STORAGE	6	1.03	85.76
22	LACK OF TRAINING DOCUMENTATION	6	1.03	86.79
23	INADEQUATE/MISSING OIL AND HAZARDOUS SUBSTANCE CONTINGENCY PLAN	6	1.03	87.82
24	CONTRACTORS PURCHASE MATERIALS WITHOUT NOTIFYING BEE, FIRE DEPT, OR SAFETY	5	0.86	88.68
25	BATTERY RECHARGE AREA LACKS NEUTRALIZER	4	0.69	89.37
26	IMPROPER DRUM STORAGE	4	0.69	90.05
27	INCOMPLETE SPILL PREVENTION CONTROL AND COUNTERMEASURES PLAN	4	0.69	90.74
28	NONCOMPLIANCE WITH RCRA REGULATION	4	0.69	91.42
29	NO SPILL REPORTING PROCEDURES	4	0.69	92.11
30	LEAKING/OPENED CONTAINERS STORED IN HAZ MAT STORAGE AREAS	4	0.69	92.80
31	FAILURE TO PROVIDE MSDS (GOCESS)	3	0.51	93.31
32	INADEQUATE HAZARDOUS MATERIALS INSPECTION PROGRAM	3	0.51	93.83

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

33	NO INSPECTION RECORDS FOR EMERGENCY EYEWASH & SHOWER	3	0.51	94.34
34	LACK OF HAZMAT TRAINING	3	0.51	94.85
35	FLAMMABLE STORAGE CABINETS LACK 3 POINT LOCKS	3	0.51	95.37
36	HAZARDOUS MATERIALS STORED WITH EXPIRED SHELF-LIVES	3	0.51	95.88
37	IGNITION SOURCES NOT KEPT AWAY FROM FLAMMABLE MATERIALS	3	0.51	96.40
38	LACK OF ADEQUATE # OF PERSONNEL WITH CERTIFICATION AS FIRST LEVEL RESPONDERS	2	0.34	96.74
39	FAILURE TO TRAIN HAZARDOUS MATERIALS TRANSPORTERS	2	0.34	97.08
40	FAILURE TO PROPERLY IDENTIFY HAZARDOUS MATERIALS	2	0.34	97.43
41	IMPROPER WRITTEN HAZARD COMMUNICATION PROGRAM	2	0.34	97.77
42	MISLABELED WASTE OIL DRUMS	2	0.34	98.11
43	IMPROPER DRAIN IN HAZARDOUS MATERIALS STORAGE	2	0.34	98.46
44	OSHA "HAZWOPER" TRAINING NOT CONDUCTED	2	0.34	98.80
45	GOCESS NOT SUPPLYING LIST OF HAZ MATS TO BEE AND FIRE DEPT	2	0.34	99.14
46	LACK OF PLACARDS ON VEHICLES TRANSPORTING HAZARDOUS MATERIALS	1	0.17	99.31
47	AMMONIA NOT KEPT INSIDE CHLORINE STORAGE ROOM	1	0.17	99.49
48	SHOVELS USED IN HAZ MAT RESPONSE KIT ARE NOT NON-SPARKING	1	0.17	99.66
49	SPILL CLEANUP TEAM DID NOT HAVE NECESSARY BASELINE PHYSICALS	1	0.17	99.83
50	NO SPILL RESPONSE PROCEDURES FOR ETHYLENE GLYCOL	1	0.17	100.00
	TOTALS	583	100.00	

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

ACC HAZARDOUS WASTE ANALYSIS

	FINDING	#	%	CUMM %	OEA'S
1	UNCHARACTERIZED AND/OR UNLABELED HAZ WASTE	36	6.83	6.83	9
2	CONTINGENCY PLANS NOT REVIEWED/UPDATED	10	1.90	8.73	6
3	INCOMPLETE HAZ WASTE MANIFEST	6	1.14	9.87	5
4	INCOMPLETE WASTE ANALYSIS PLAN	2	0.38	10.25	5
5	IMPROPER/NONEXISTENT LABELING OF HAZ WASTE	29	5.50	15.75	4
6	AP/SAP RECORDS DID NOT TRACK TIME BETWEEN START AND DEPARTURE DATES	16	3.04	18.79	4
7	ABSENCE FO OR INCORRECT LAND DISPOSAL RESTRICTION	10	1.90	20.68	4
8	DEFICIENT TSDF INSPECTION LOGS	1	0.19	20.87	4
9	IMPROPER STORAGE OF HAZ WASTE/LACK OF CHARACTERIZATION	48	9.11	29.98	3
10	LACK OF TRAINING/DOCUMENTATION FOR TSDF PERSONNEL	13	2.47	32.45	3
11	FAILURE TO AMEND PART A PERMIT	11	2.09	34.54	3
12	TRNG RCRDS LACKING JOB DESCRPTN, TITLE, PAST TRNG, & NOT MAINTAINED FOR 3 YRS	11	2.09	36.62	3
13	PART B APPLICATION INCONSISTENT WITH PERMIT	9	1.71	38.33	3
14	INCOMPLETE HAZARDOUS WASTE REPORT	6	1.14	39.47	3
15	FAILURE TO SUBMIT QUARTERLY WASTE REPORTS	6	1.14	40.61	3
16	HAZ WAQSTE CONTAINERS LEFT OPEN DURING STORAGE	6	1.14	41.75	3
17	WEEKLY RECORDS INCOMPLETE AND CONTRADICTORY	4	0.76	42.50	3
18	LACK OF MANIFESTS FOR HAZ WSTE SENT FOR RECYCLING	3	0.57	43.07	3
19	DISPOSING OF HAZ WASTE IN DUMPSTER/LAND WITHOUT PERMIT	39	7.40	50.47	2
20	INACCURATE SPILL RESPONSE PLAN	13	2.47	52.94	2
21	DISPOSING OF HAZARDOUS WASTE THROUGH SEWAGE SYSTEM	9	1.71	54.65	2
22	LACK OF SPILL RESPONSE EQUIPMENT	9	1.71	56.36	2
23	DISCREPANCIES BETWEEN PERMIT AND CURRENT OPERATIONS	5	0.95	57.31	2
24	WASTE ANALYSIS DATA NOT PROVIDED TO TSDF	2	0.38	57.69	2
25	FAILURE TO DOCUMENT INSPECTIONS OF EOD UNITS	2	0.38	58.06	2
26	FAILURE TO CLOSE A TREATMENT UNIT	1	0.19	58.25	2
27	FAILURE TO CLOSE HAZ WASTE UNIT	1	0.19	58.44	2
28	DISPOSING OF SPENT HAZ WASTE RAGS AS SOLID WASTE	10	1.90	60.34	1
29	NONCOMPLYING HAZ WASTE STORAGE FACILITY	9	1.71	62.05	1
30	HAZ WASTE MANIFESTS NOT MAINTAINED FOR 3 YRS	8	1.52	63.57	1
31	TRAINING RECORDS AT AP INCOMPLETE AND NOT AT FACILITY	5	0.95	64.52	1
32	CONTAMINATED SOIL UNMARKED AND UNTESTED	5	0.95	65.46	1
33	LACK OF TCLP TESTING	5	0.95	66.41	1
34	UNPERMITTED TREATMENT OF HAZARDOUS WASTE	4	0.76	67.17	1

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

35	IMPROPER WASTE TRANSPORTATION AND STORAGE FROM OFF-SITE	4	0.76	67.93	1
36	IMPROPER NOTIFICATION TO HAZ WSTE RECEIVING FACILITY	3	0.57	68.50	1
37	NOTIFICATION OF WASTE DID NOT INCLUDE ALL ACTIVITY	3	0.57	69.07	1
38	EXPIRED SHELF-LIFE ITEMS STORED LONGER THAN 90 DAYS	2	0.38	69.45	1
39	IMPROPER DISPOSAL OF EOD BURN RESIDUE	2	0.38	69.83	1
40	LACK OF TELEPHONE AT AP	1	0.19	70.02	1
41	FAILURE TO MAINTAIN RESTRICTED WSTE NOTIFICATION FOR 5 YRS	1	0.19	70.21	1
42	INADEQUATE AISLE SPACE AT ACCUMULATION POINT	1	0.19	70.40	1
43	FAILURE TO SUBMIT HAZ WASTE MANIFEST TO STATE	1	0.19	70.59	1
44	INADEQUATE ACCUMULATION POINT STORAGE	8	1.52	72.11	
45	INADEQUATE WASTE MINIMIZATION PROGRAM	8	1.52	73.62	
46	SAP EXCEEDED 55 GAL LIMIT OR 3 DAYS	8	1.52	75.14	
47	SAP ACCEPTED WASTES GENERATED FROM OTHER FACILITIES	7	1.33	76.47	
48	LACK OF HAZARDOUS WASTE SIGNS	7	1.33	77.80	
49	INADEQUATE/INCOMPLETE SPCC	7	1.33	79.13	
50	LACK OF FIRE EXTINGUISHER	6	1.14	80.27	
51	IMPROPER DISPOSAL OF WASTE OIL	6	1.14	81.40	
52	FAILURE TO DOCUMENT PROCESS KNOWLEDGE FOR 3 YRS	6	1.14	82.54	
53	HAZARDOUS WASTE CONTAINERS RUSTED/NOT SEALED	6	1.14	83.68	
54	INADEQUATE CONTINGENCY PLANS AT SAPS	5	0.95	84.63	
55	IMPROPER MIXING OF INCOMPATIBLE HAZ WASTE	5	0.95	85.58	
56	LACK OF SAF FOR WASTE ORDNANCE	5	0.95	86.53	
57	IMPROPER HANDLING OF EMPTY HAZ MAT CONTAINERS	4	0.76	87.29	
58	ABSENCE OF INTERIM STATUS DOCUMENTS	4	0.76	88.05	
59	LACK OF HAZARDOUS WASTE MANAGEMENT PLAN	4	0.76	88.80	
60	DEFICIENT/INCOMPLETE BIENNIAL HAZARDOUS WASTE REPORT	4	0.76	89.56	
61	IMPROPER LABELING OF HAZ WASTE	4	0.76	90.32	
62	FAILURE TO IDENTIFY ACCUMULATION PTS TO FIRE DEPT	3	0.57	90.89	
63	LACK OF ACCUMULATION PT MONITOR DOCUMENTATION	3	0.57	91.46	
64	IMPROPER DISPOSAL OF FLOURESCENT TUBES	3	0.57	92.03	
65	INCONSISTENT MANAGEMENT OF WASTE BATTERIES	3	0.57	92.60	
66	IMPROPER DISPOSAL OF WASTE SILVER FROM RECOVERY UNITS	3	0.57	93.17	
67	LACK OF SECONDARY CONTAINMENT FOR HAZ WASTE STORAGE	3	0.57	93.74	
68	DISCHARGING HAZARDOUS WITHOUT A PERMIT	2	0.38	94.12	
69	DISPOSING OF INCINERATOR WASTE WITHOUT TESTING	2	0.38	94.50	
70	INACCURATE PART B PERMIT	2	0.38	94.88	
71	IMPROPER DISPOSAL OF PHARMACEUTICALS	2	0.38	95.26	

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

72	UNCHARACTERIZED WASTE STREAMS	2	0.38	95.64	
73	IMPROPER LABELING OF ANTIFREEZE DRUMS	2	0.38	96.02	
74	OUTDATED SAP LOCATION	2	0.38	96.39	
75	INADEQUATE INSPECTION OF OPEN BURN/DETONATION UNITS	2	0.38	96.77	
76	HAZ WASTE TRANSPORTATERS NOT PROPERLY TRAINED	2	0.38	97.15	
77	EOD RESPONDING OFF BASE WITH STATE PERMIT	2	0.38	97.53	
78	IMPROPER STORAGE/DISPOSAL HAZ WASTE CONTRACTORS YARD	2	0.38	97.91	
79	ABSENCE OF KLAXON AT DRMO	1	0.19	98.10	
80	IMPROPER NEUTRALIZATION OF BATTERY WASTE PRIOR TO DISPOSAL	1	0.19	98.29	
81	MONTHLY M-15 REPORTS LACKING	1	0.19	98.48	
82	UNIDENTIFIED HAZ WASTE UNIT	1	0.19	98.67	
83	FAILURE TO PREVENT RELEASES AT EOD BURN UNIT	1	0.19	98.86	
84	IMPROPER STORAGE/DISPOSAL OF PHENOL	1	0.19	99.05	
85	IMPROPER HAZ WASTE DEPOSIT AT AP BY UNKNOWN GENERATORS	1	0.19	99.24	
86	FAILURE TO CHARACTERIZE WASTE ORDNANCE	1	0.19	99.43	
87	LACK OF WATER SUPPLY AT ACCUMULATION POINT	1	0.19	99.62	
88	IMPROPER DISPOSAL OF HAZ WASTE THRU OIL/WATER SEPARATOR	1	0.19	99.81	
89	USE OF SPARKING SHOVEL IN SPILL EQUIPMENT	1	0.19	100.00	
	TOTAL	527	100.00		105

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

ACC POL ANALYSIS

	FINDING	#	%	CUMM %	OEA'S
1	FAILURE TO APPROPRIATELY RESPOND TO POL SPILLS	11	3.33	3.33	6
2	FAILURE TO REGISTER USTS AND AGTS WITH STATE	12	3.64	6.97	4
3	ABOVE GROUND STORAGE TANKS (AGTS) LACK SECONDARY CONTAINMENT	36	10.91	17.88	3
4	IMPROPERLY ABANDONED UNDERGROUND STORAGE TANKS (UST)	7	2.12	20.00	3
5	FAILURE TO PROTECT OR REMOVE USTS	1	0.30	20.30	3
6	ABOVE GROUND TANK DIKE DRAIN VALVES NOT LOCKED	20	6.06	26.36	2
7	INADEQUATE AGT/UST RECORDS	18	5.45	31.82	2
8	FUEL TANK LEAKING	16	4.85	36.67	2
9	FAILURE TO PROVIDE CATHODIC PROTECTION TO PIPES	6	1.82	38.48	2
10	INADEQUATE PRODUCT RECOVERY SYSTEM	4	1.21	39.70	2
11	STORAGE DIKE NOT IMPERVIOUS	45	13.64	53.33	1
12	INADEQUATE SPILL PREVENTION TRAINING/DOCUMENTATION	18	5.45	58.79	1
13	INADEQUATE/MISSING CATHODIC PROTECTION INSPECTION RECORDS	7	2.12	60.91	1
14	FAILURE TO PROPERLY CLOSE/DOCUMENT UST	7	2.12	63.03	1
15	INADEQUATE RELEASE DETECTION	4	1.21	64.24	1
16	LACK OF SPILLAND OVERFILL PROTECTION FOR UST	4	1.21	65.45	1
17	LACK OF INSPECTION RECORDS FOR AGTS	3	0.91	66.36	1
18	FAILURE TO TEST UST AND PIPING FOR TIGHTNESS	3	0.91	67.27	1
19	UNSECURED UST FILL CAPS	2	0.61	67.88	1
20	FAILURE TO INSTALL RELEASE DETECTION DEVICES	2	0.61	68.48	1
21	FAILURE TO DOCUMENT REPORTING OF KNOWN RELEASES	2	0.61	69.09	1
22	NO CONTAINMENT AT POL FILLSTAND AND OFF LOADING AREA	15	4.55	73.64	
23	INADEQUATE SPILL PREVENTION AND RESPONSE PLAN	12	3.64	77.27	
24	SPILL PREVENTION PLAN NOT REVIEWED/UPDATED EVERY 3 YEARS	11	3.33	80.61	
25	IMPROPERLY MARKED DISPOSAL DRUMS	8	2.42	83.03	
26	LACK OF SPILL CLEAN UP EQUIPMENT	8	2.42	85.45	
27	DIKED AREAS DRAIN TO DITCHES (STORMWATER)	7	2.12	87.58	
28	INADEQUATE PIPELINE RESSURE TESTING/DOCUMENTATION	6	1.82	89.39	
29	DRUMS OF POL HAVE NO SECONDARY CONTAINMENT	6	1.82	91.21	
30	LACK OF PLAN FOR RECOVERABLE AND WASTE LIQUID POL	5	1.52	92.73	
31	LACK OF SIGNAGE ON ABOVE GROUND TANKS	5	1.52	94.24	
32	INADEQUATE CORROSION CONTROL	5	1.52	95.76	

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

33	ABOVE GROUND TANK FILL CAPS NOT LOCKED	3	0.91	96.67	
34	INADEQUATE CERTIFIED CALIBRATION CHARTS	3	0.91	97.58	
35	OIL/WATER SEPARATORS LACK MAINTENANCE	2	0.61	98.18	
36	ABOVE GROUND TANKS NOT INSPECTED ON SCHEDULE	2	0.61	98.79	
37	IMPROPER CONTAINMENT AND MAINTENANCE OF ASPHALT SEALANT TANK	1	0.30	99.09	
38	UNSERVICEABLE FILL LINE COVER FOR UST	1	0.30	99.39	
39	FAILURE TO IMPLEMENT SPR/SPCC PLAN	1	0.30	99.70	
40	IMPROPER INSTALLATION OF UST	1	0.30	100.00	
41	TOTALS	330	100.00		40

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES

ACC SPECIAL PROGRAMS ANALYSIS

	FINDING	#	%	CUMM %	OEA'S
1	IMPROPER LABELING OF PCB WASTE CONTAINERS	14	14.58	14.58	
2	INCOMPLETE BASEWIDE PCB INVENTORY	13	13.54	28.13	
3	LACK OF INSPECTIONS AND LOGS FOR PCB STORAGE	11	11.46	39.58	
4	LEAKING TRANSFORMERS	9	9.38	48.96	
5	LACK OF DOCUMENTATION FOR TRACKING PCB FROM CRADLE TO GRAVE	9	9.38	58.33	
6	MISLABELED PCB TRANSFORMERS	8	8.33	66.67	
7	PCB STORAGE AREA DOES NOT MEET REGULATORY REQUIREMENT	6	6.25	72.92	
8	LACK OF ANNUAL PCB REPORT	6	6.25	79.17	
9	ABSENCE OF PCB MARKING AT WASTE STORAGE SITE	5	5.21	84.38	
10	TRANSFORMERS ANALYZED BY CHLOR-N-OIL NOT LABS	4	4.17	88.54	
11	PCB STORAGE ITEMS EXCEED TIME LIMITATIONS	4	4.17	92.71	
12	IMPROPER STORAGE OF PCB TRANSFORMERS	2	2.08	94.79	
13	LACK OF DOCUMENTATION OF COMMERCIAL TRANSFORMERS	2	2.08	96.88	
14	PCB TRANSFORMERS NOT PROPERLY REGISTERED	1	1.04	97.92	
15	FAILURE TO NOTIFY STATE EPA OF PCB WASTE ACTIVITY	1	1.04	98.96	
16	INADEQUATE MANAGEMENT OF PCBS	1	1.04	100.00	
	TOTALS	96	100.00		
1	IMPROPER REMOVAL OF FRIABLE ASBESTOS	7	8.43	8.43	1
2	LACK OF ASBESTOS CERTIFICATIONS	2	2.41	10.84	1
3	MISSING/OR INCOMPLETE ASBESTOS MANAGEMENT/OPS PLAN	22	26.51	37.35	
4	INCOMPLETE ASBESTOS SURVEY	11	13.25	50.60	
5	ASBESTOS PROJECT NOTIFICATIONS NOT SUBMITTED TO EPA	9	10.84	61.45	
6	IMPROPER DISPOSAL OF ASBESTOS	9	10.84	72.29	
7	IMPROPER LABELING OF ASBESTOS WASTE CONTAINERS	6	7.23	79 52	
8	LACK OF ADEQUATE ASBESTOS TRAINING	5	6.02	85 54	
9	FAILURE TO MARK ASBESTOS RELATED DOCUMENTATION FOR INDEFINITE RETENTION	5	6.02	91 57	
10	ASBESTOS WASTE STORED IN NONSECURE LOCATION	3	3.61	95.18	
11	IMPROPER MANAGEMENT OF ASBESTOS LANDFILL	2	2.41	97.59	
12	LACK OF FRIABLE ASBESTOS CORRECTIVE ACTION PLAN	1	1.20	98.80	
13	LACK OF PHYSICAL FOR ASBESTOS REMOVAL TEAM	1	1.20	100.00	
	TOTALS	83	100.00		2

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES

1	FAILURE TO FORMALIZE TECHNICAL REVIEW COMMITTEE	9	34.62	34.62	
2	EIAP DOCUMENTS NOT REVIEWED BY EPC OR SJA	8	30.77	65.38	
3	LACK OF EIAP PROGRAM	4	15.38	80.77	
4	ENVIRONMENTAL IMPACTS OF PROJECT NOT ADDRESSED IN EIAP	2	7.69	88.46	
5	NO SYSTEM TO ENSURE COMPLIANCE WITH NEPA	2	7.69	96.15	
6	INAPPROPRIATE APPLICATION OF CATEGORICAL EXCLUSIONS	1	3.85	100.00	
	TOTALS	26	100.00		
1	INCOMPLETE/LACKING IRP ADMINISTRATION RECORD	15			
2	INCOMPLETE IRP DECISION DOCUMENT	1			
1	INCOMPLETE A-106 PROGRAM	10			
2	INADEQUATE A-106 TRAINING	2			
1	FAILURE TO MITIGATE RADON	6			

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

ACC WATER QUALITY ANALYSIS

	FINDING	#	%	CUMM %	OEA'S
1	IMPROPER DISCHARGE TO SANITARY/STORM WATER	6	2.67	2.67	8
2	EXCEEDING NPDES WWTP PARAMETERS	13	5.78	8.44	5
3	IMPROPER OPERATION AND MAINTENANCE OF LAGOONS	4	1.78	10.22	2
4	ELEVATED SILVER LEVELS IN DISCHARGE WATER	1	0.44	10.67	2
5	FAILURE TO MEET ALL NPDES PERMIT REQUIREMENTS	15	6.67	17.33	1
6	NO PERMIT OBTAINED FOR LAND DISPOSAL FOR WWTP SLUDGE	5	2.22	19.56	1
7	UNCHARACTERIZED INDUSTRIAL WASTE DISCHARGES	4	1.78	21.33	1
8	LACK OF ICE MACHINE COLIFORM LEVEL SAMPLES	3	1.33	22.67	1
9	FAILURE TO TEST STORMWATER RUNOFF FROM LANDFILL AREA	1	0.44	23.11	1
10	PRIMARY DRINKING WATER STANDARD EXCEEDED WITHOUT PROPER MGT ACTION	1	0.44	23.56	1
11	INADEQUATE OIL/WATER SEPARATOR MANAGEMENT PROGRAM	34	15.11	38.67	
12	NO NPDES PERMIT	14	6.22	44.89	
13	LACK OF BACK-FLOW /CROSS CONNECTION PREVENTION PROGRAM	13	5.78	50.67	
14	FAILURE TO PROPERLY MANAGE DRINKING WATER IAW REGULATORY REQUIREMENTS	12	5.33	56.00	
15	BASE SANITARY/STORM WATER PLANS OUTDATED	9	4.00	60.00	
16	NO LEAD ANALYSIS PUBLIC NOTIFICATION	8	3.56	63.56	
17	NO WATER DISTRIBUTION SANITARY SURVEYS	6	2.67	66.22	
18	LACK OF WATER QUALITY REGULATIONS	6	2.67	68.89	
19	LACK OF STATE CERTIFICATION FOR WATER/WASTEWATER OPERATIONS	6	2.67	71.56	
20	LACK OF DRINKING WATER CORROSSIVITY ANALYSIS	5	2.22	73.78	
21	UNCHARACTERIZED SURFACE WATER DISCHARGE	5	2.22	76.00	
22	NO PROGRAM EXISTS TO REPLACE INEFFICIENT DRINKING WATER SYSTEMS	4	1.78	77.78	
23	INADEQUATE SEWER SYSTEM	3	1.33	79.11	
24	FAILURE TO SEAL DRINKIN WATER SOURCE TO PREVENT CONTAMINATION	3	1.33	80.44	
25	UNPERMITTED UNDERGROUND DISCHARGE	3	1.33	81.78	
26	FAILURE TO COORDINATE MODIFICATION OF WATER SYSTEMS WITH BEE	3	1.33	83.11	
27	FAILURE TO MAINTAIN SANITARY SYSTEMS SURVEYS FOR 10 YEARS	3	1.33	84.44	
28	IMPROPERLY ABANDONED WELLS	2	0.89	85.33	
29	INADEQUATE SURFACE WATER SAMPLING	2	0.89	86.22	
30	DRINKING WATER NOT TESTED FOR RADIUM	2	0.89	87.11	
31	DRINKING WATER NOT TESTED FOR TRIHALAMETHANES	2	0.89	88.00	
32	NO RECORD OF CERTIFICATION FOR LABORATORIES USED IN WATER ANALYSIS	2	0.89	88.89	

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

33	INACCURATE REPORTING OF WASTE WATER DISCHARGE MONITORING RESULTS	2	0.89	89.78	
34	NO POLICY FOR DISCHARGING INTO SEWER SYSTEM	2	0.89	90.67	
35	NO IRP SAMPLING PROVISIONS	1	0.44	91.11	
36	SEWER SYSTEM JP-4 INFILTRATION NOT INVESTIGATED	1	0.44	91.56	
37	LACK OF EROSION CONTROL PLAN/PROGRAM	1	0.44	92.00	
38	FAILURE TO SECURE WATER WELLS FROM UNAUTHORIZED ENTRY	1	0.44	92.44	
39	LACK OF EMERGENCY PREPAREDNESS PLAN FOR WATER SUPPLY SYSTEM	1	0.44	92.89	
40	FAILURE TO IMPLREMENT AF AND OSHA SAFETY STANDARDS AT WWTP	1	0.44	93.33	
41	LACK OF SELF-CONTAINED BREATHING APPARATUS AT WWTP	1	0.44	93.78	
42	SEPTIC TANK PERMITS OBTAINED FROM ORGANIZATIONS OTHER THAN CE	1	0.44	94.22	
43	WASTEWATER CHLORINATION ROOM EXHAUST FAN INOPERATIVE	1	0.44	94.67	
44	IMPROPER SANITARY SEWER AFFF SYSTEM DISCHARGE	1	0.44	95.11	
45	ABSENCE OF PUMPING OF SEPTIC TANKS	1	0.44	95.56	
46	BASE POLLUTION MONITORING PLAN OUTDATED	1	0.44	96.00	
47	FAILURE TO NOTIFY OF LOW CHLORINE LEVELS IN DRINKING WATER	1	0.44	96.44	
48	RESPIRATORY PROTECTION TRAINING INADEQUATE	1	0.44	96.89	
49	IMPROPER SEPTIC FIELD LOCATION	1	0.44	97.33	
50	FIRE TRAINING BURN AREA HAS NO DOUBLE LINER	1	0.44	97.78	
51	INADEQUATE DESIGN AFFF SYSTEM	1	0.44	98.22	
52	INSUFFICIENT TESTING AT WASTE WATER TREATMENT PLANT	1	0.44	98.67	
53	WWTP LABORATORY INSTRUMENT CALIBRATION LOG NOT AVAILABLE FOR REVIEW	1	0.44	99.11	
54	INCONSISTENCIES IN LABORATORY ANALYSIS METHODS	1	0.44	99.56	
55	EXCEEDED DISCHARGE LIMITATIONS FOR DISCHARGE TO POTW	1	0.44	100.00	
	TOTALS	225	100.00		23

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

ACC PESTICIDE MANAGEMENT ANALYSIS

	FINDING	#	%	CUMM %	OEA'S
1	LACK OF COVERED STORAGE FOR LARGE PESTICIDE APPLICATION EQUIPMENT	23	10.95	10.95	
2	IMPROPER STORAGE OF PESTICIDES	19	9.05	20.00	
3	NO SPECIFIC FACILITY DESIGNED TO CONTAIN SPILLS OR COLLECT WASHWATER	19	9.05	29.05	
4	UNMARKED PESTICIDE APPLICATION EQUIPMENT	17	8.10	37.14	
5	PESTICIDES DRAIN INTO SANITARY SEWER/STORM WATER SYSTEM	15	7.14	44.29	
6	INVENTORIES/SIGNS NOT POSTED ON PESTICIDE STORAGE AREAS	14	6.67	50.95	
7	LACK OF DECONTAMINATION FACILITY	11	5.24	56.19	
8	ABSENCE OF CLIMB RESISTANT FENCE AROUND PEST MANAGEMENT FACILITY	8	3.81	60.00	
9	PHYSICAL EXAMS FOR PESTICIDE APLLICATORS NOT PROPERLY MANAGED	8	3.81	63.81	
10	PEST CONTROL CONTRACTS NOT REVIEWED BY PEST MANAGEMENT OR BEE	7	3.33	67.14	
11	INADEQUATE PESTICIDE CONTAINMENT	6	2.86	70.00	
12	LACK OF EMERGENCY AND SPILL RESPONSE EQUIPMENT	6	2.86	72.86	
13	LACK OF DoD PESTICIDE APPLICATION CERTIFICATION	5	2.38	75.24	
14	LACK OF QUARTERLY SUMMARY REPORTS	5	2.38	77.62	
15	STORM WATER RUNOFF COLLECTIONS SYSTEM INADEQUATE	5	2.38	80.00	
16	LACK OF NECESSARY PEST MANAGEMENT PUBLICATIONS	5	2.38	82.38	
17	INADEQUATE VENTILATION IN MIXING AND STORAGE ROOM	4	1.90	84.29	
18	PEST MANAGEMENT PEST MANAGEMENT PLAN NOT APPROVED BY HQ ACC	4	1.90	86.19	
19	PESTICIDE VEHICLE NOT EQUIPPED WITH AIR CONDITIONING	3	1.43	87.62	
20	INADEQUATE PREFIRE PLANNING FOR PESTICIDE FACILITY	3	1.43	89.05	
21	IMPROPER DISPOSAL OF PESTICIDES	2	0.95	90.00	
22	IMPROPER FIRE EXTINGUISHERS IN PEST MANAGEMENT AREAS	2	0.95	90.95	
23	PESTICIDE CONTAINERS NOT DISPOSED IN MANNER CONSISTENT WITH LABELING	2	0.95	91.90	
24	VENTILATION SYSTEM NOT CHECKED PERIODICALLY	2	0.95	92.86	
25	DETERIORATED STORAGE CONTAINERS	2	0.95	93.81	
26	PESTICIDES ARE MIXED IN FIELD RATHER THAN IN AUTHORIZED FACILITY	2	0.95	94.76	
27	MILITARY PUBLIC HEALTH NOT NOTIFIED PRIOR TO PETSICIDE APLLICATION IN FOOD	2	0.95	95.71	
28	NO PHYSICAL SEPARATION BETWEEN MIXING, CLEANING, EATING, AND WORK AREAS	2	0.95	96.67	
29	HERBICIDES, INSECTICIDES, FUNGICIDES, AND RODENTICIDES NOT STORED SEPARATELY	2	0.95	97.62	
30	INADEQUATE RESPIRATORY EQUIPMENT	1	0.48	98.10	
31	PESTICIDE APPLICATION EQUIUPMENT NOT DEDICATED TO PEST MANAGEMENT	1	0.48	98.57	
32	BASE SELF-HELP DISTRIBUTION PESTICIDES TO FAMILY HOUSING OCCUPANTS	1	0.48	99.05	
33	LACK OF EPA PESTICIDE APPLICATION CERTIFICATION FOR GROUND CONTRACTOR	1	0.48	99.52	
34	UNREGISTERED USE OF PESTICIDE	1	0.48	100.00	
	TOTALS	210	100.00		

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

ACC AIR QUALITY ANALYSIS

	FINDING	#	%	CUMM %	OEA'S
1	LACK OF AIR PERMITS FOR EMISSION SOURCES	28	17.28	17.28	2
2	LACK OF CONSTRUCTION PERMITS	6	3.70	20.99	2
3	LACK OF VAPOR RECOVERY SYSTEMS	11	6.79	27.78	1
4	VOC PERMIT LIMITATIONS EXCEEDED	3	1.85	29.63	1
5	PERMIT OPERATING CONDITIONS NOT FOLLOWED	12	7.41	37.04	
6	FAILURE TO CLOSE LID ON SOLVENT TANKS	9	5.56	42.59	
7	LACK OF CFCS & HALON REPORTS	7	4.32	46.91	
8	LACK OF AIR EMISSIONS INVENTORIES	6	3.70	50.62	
9	INSTALLATION OPERATING PERMITS NOT POSTED	5	3.09	53.70	
10	LACK OF SIGNS FOR UNLEADED GAS	4	2.47	56.17	
11	INADEQUATE GASOLINE ENGINE INSPECTION FOR EXHAUST GASES	4	2.47	58.64	
12	LACK OF TEMPERATURE MEASURE ON SECONDARY COMBUSTION CHAMBER (INCINERATO	4	2.47	61.11	
13	LACK OF PERMIT FOR OPEN BURNING	4	2.47	63.58	
14	INADEQUATE RETEST PROCEDURES FOR VEHICLES FILING EXHAUST EMISSIONS TESTING	3	1.85	65.43	
15	INADEQUATE BULK FUEL TANK INSPECTION	3	1.85	67.28	
16	LACK OF OPERATING INSTRUCTION/PERMIT DEGREASERS	3	1.85	69.14	
17	NITRATE OXIDE NOT MONITORED	3	1.85	70.99	
18	DEFICIENT AIR EMISSIONS INVENTORY	3	1.85	72.84	
19	FAILURE TO LEAK TEST FUEL DELIVERY TANKS	2	1.23	74.07	
20	INADEQUATE BULK FUEL TANK RECORDKEEPING	2	1.23	75.31	
21	PAINT LOGS NOT KEPT	2	1.23	76.54	
22	INOPERATIVE CO2 MONITOR	2	1.23	77.78	
23	OPEN BURNING OF EXPLOSIVE MATERIALS WITHOUT APPROVAL	2	1.23	79.01	
24	LACK OF AIR PERMITS FOR LAND CLEARING	2	1.23	80.25	
25	NO AIR EPISODE PLAN	2	1.23	81.48	
26	NO PARTICULATE EMISSION MONITORING	2	1.23	82.72	
27	IMPROPER PATHOLOGICAL INCINERATOR USE	2	1.23	83.95	
28	CLASSIFIED/PATHOLOGICAL INCINERATOR REPORTING REQUIREMENTS NOT MET	1	0.62	84.57	
29	INADEQUATE VEHICLE TEST RECORDS	1	0.62	85.19	
30	FAILURE TO UPDATE HEAT PLANT PERMIT FOR TYPE FUEL BURNED	1	0.62	85.80	
31	FAILURE TO POST PERMIT AT HEAT PLANT	1	0.62	86.42	
32	LACK OF TRAINING ON OPACITY LIMITS FOR HOSPITAL INCINERATOR	1	0.62	87.04	

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

33	LACK OF CALIBRATION OF VEHICLE EXHAUST ANALYZER	1	0.62	87.65	
34	PERSONNEL UNKNOWLEDGEABLE OF STATE AIR POLLUTION REGULATIONS	1	0.62	88.27	
35	NONCOMPLIANCE WITH OPEN BURN PERMIT	1	0.62	88.89	
36	INADEQUATE SUBMERGED FILL PIPE-FUEL STORAGE	1	0.62	89.51	
37	JP4 TANK VAPOR EMISSIONS NOT CONTROLLED	1	0.62	90.12	
38	FAILURE TO RENEW LICENSE OF BASE HEAT PLANT	1	0.62	90.74	
39	FAILURE TO OBTAIN FOR HOSPITAL INCINERATOR	1	0.62	91.36	
40	FAILURE TO SUBMIT QUARTERLY SOLID FUEL REPORT	1	0.62	91.98	
41	FAILURE TO REGISTER AIR EMISSION SOURCES THAT EMIT MORE THAN SPECIFIED AMOUN	1	0.62	92.59	
42	CLASSIFIED INCINERATOR NOT IN COMPLIANCE WITH STATE RULES	1	0.62	93.21	
43	CORROSION CONTROL NOT COMPLYING WITH LOCAL RULES	1	0.62	93.83	
44	LACK OF STATE VEHICLE DECALS FOR EMISSION	1	0.62	94.44	
45	ARCHITECTURAL COATINGS DO NOT COMPLY WITH LOCAL RULES	1	0.62	95.06	
46	SOLVENT CLEANERS NOT IN COMPLIANCE WITH REQUIREMENTS	1	0.62	95.68	
47	IMPROPER STORAGE OF SOLVENTS	1	0.62	96.30	
48	FAILURE TO CLEAN DUST COLLECTIONS FILTERS	1	0.62	96.91	
49	LACK OF RESPIRATORY EQUIPMENT WHILE SANDING LEAD BASED PAINT	1	0.62	97.53	
50	FAILURE TO RECLAIM FREON	1	0.62	98.15	
51	FAILURE TO TEST INCINERATOR	1	0.62	98.77	
52	LACK OF PREVENTION AND REDUCTION OF VOCS	1	0.62	99.38	
53	USE OF HIGH VOC CONTAINING MATERIAL	1	0.62	100.00	
	TOTALS	162	100.00		6

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

ACC SOLID WASTE ANALYSIS

	FINDING	#	%	CUMM %	OEA'S
1	UNPERMITTED LANDFILL	6	4.38	4.38	1
2	FAILURE TO COMPLETE AND FILE LANDFILL CLOSURE PLAN	4	2.92	7.30	1
3	RUNOFF WATER THROUGH LANDFILL IS NOT CONTROLLED	1	0.73	8.03	1
4	UNPERMITTED OPEN DUMPSITE	24	17.52	25.55	
5	LACK OF PERMIT FOR CONSTRUCTION DEBRIS LANDFILL	16	11.68	37.23	
6	IMPROPER DISPOSAL OF HAZARDOUS WASTE IN SOLID WASTE CONTAINER	9	6.57	43.80	
7	FAILURE TO RECYCLE PAPER	8	5.84	49.64	
8	FAILURE TO CLOSE DUMPSTER LIDS	7	5.11	54.74	
9	IMPROPER DISPOSAL OF PATHOLOGICAL WASTE	6	4.38	59.12	
10	FAILURE TO INSPECT DUMPSTERS AT LEAST QUARTERLY	6	4.38	63.50	
11	APPLICABLE REGULATIONS UNAVAILABLE	6	4.38	67.88	
12	OFF-BASE LANDFILL PERMIT STATUS UNKNOWN	5	3.65	71.53	
13	FAILURE TO INSPECT OFF BASE LANDFILL QUARTERLY	5	3.65	75.18	
14	SCRAP TIRES IMPROPERLY DISPOSED OF	4	2.92	78.10	
15	REFUSE RECEPTACLES NOT WATERPROOF	3	2.19	80.29	
16	UNPERMITTED DUMPING IN CLOSED LANDFILL	2	1.46	81.75	
17	LACK OF DOCUMENTATION OF INTL WASTE HANDLING FOR USDA	2	1.46	83.21	
18	FAILURE TO ACCOMPLISH RECYCLING STUDY	2	1.46	84.67	
19	IMPROPER MANAGEMENT OF SANITARY LANDFILL	2	1.46	86.13	
20	INADEQUATE RECORDKEEPING OF SOLID WASTE DISPOSED IN LANDFILL	2	1.46	87.59	
21	INCINERATOR INSECURE	2	1.46	89.05	
22	FAILURE TO ADVERTISE PROHIBITED MATERIAL IN DUMPSTERS	2	1.46	90.51	
23	IMPROPER STORAGE OF SCRAP VEHICLES	1	0.73	91.24	
24	LACK OF ANNUAL REVIEW OF COMPLIANCE AGREEMENT WITH STATE	1	0.73	91.97	
25	IMPROPER TREATMENT OF PETROLEUM CONTAMINATED SOIL	1	0.73	92.70	
26	ASBESTOS LANDFILL TRENCH NOT PERPENDICULAR TO PREVAILING WIND	1	0.73	93.43	
27	PUBLIC ACCESS TO LANDFILL IS NOT CONTROLLED	1	0.73	94.16	
28	IMPROPER MANIFESTING OF MEDICAL WASTES	1	0.73	94.89	
29	LACK OF PROTECTIVE CLOTHING FOR PERSONNEL DISPOSING OF MEDICAL WASTES	1	0.73	95.62	
30	UNPERMITTED BURNING OF SOLID WASTE	1	0.73	96.35	
31	WASHRACK OIL/WATER SEPARATOR INOPERABLE	1	0.73	97.08	
32	LACK OF STATE PERMIT FOR RECYCLING	1	0.73	97.81	

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

33	INSUFFICIENT GUIDANCE ON AIRCRAFT REFUSE HANDLING	1	0.73	98.54	
34	LACK OF MEDICAL WASTE MANAGEMENT PLAN	1	0.73	99.27	
35	IMPROPER LABELING OF BIOHAZARD WASTE	1	0.73	100.00	
	TOTALS	137	100.00		3

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

ACC NATURAL/CULTURAL ANALYSIS

	FINDING	#	%	CUMM %	OEA'S
1	NO STAFF ASSIGNMENTS OR TRAINING	14	11.38	11.38	
2	LACK OF WETLANDS DELINEATION	11	8.94	20.33	
3	LACK OF OUTDOOR RECREATION PLAN	9	7.32	27.64	
4	INADEQUATE LAND MANAGEMENT PLAN	8	6.50	34.15	
5	DEFICIENT FISH & WILDLIFE MANAGEMENT PLAN	7	5.69	39.84	
6	LACK OF HISTORIC PRESERVATION PLAN	7	5.69	45.53	
7	NO US FISH & WILDLIFE COOPERATIVE PLAN	6	4.88	50.41	
8	ABSENCE OF CULTURAL RESOURCE SURVEY AND MGT PLAN	6	4.88	55.28	
9	LACK OF LANDSCAPE AND DEVELOPMENT PLAN	5	4.07	59.35	
10	INADEQUATE NATURAL RESOURCE PLAN	5	4.07	63.41	
11	NO BASE NATURAL RESOURCE PLAN	5	4.07	67.48	
12	LACK OF SURVEY FOR PROTECTED SPECIES	5	4.07	71.54	
13	ENDANGERED AND THREATENED SPECIES STATUS UNCLEAR	4	3.25	74.80	
14	LACK OF REGULATIONS & GUIDANCE DOCUMENTS	4	3.25	78.05	
15	FOREST MANAGEMENT PLAN LACKING/OUTDATED	4	3.25	81.30	
16	OUTDOOR REC COOPERATIVE AGREEMENT NOT SIGNED	3	2.44	83.74	
17	NATURAL/CULTURAL RESOURCES MANAGER NOT COORDINATING PROPOSED ACTIVITIES	3	2.44	86.18	
18	LACK OF RANGE MANAGEMENT PLAN	2	1.63	87.80	
19	UNAUTHORIZED OFF-ROAD VEHICLE USE	2	1.63	89.43	
20	INADEQUATE NATURAL RESOURCES EXPERTISE	1	0.81	90.24	
21	NO WETLAND CONSTRUCTION PERMIT	1	0.81	91.06	
22	INADEQUATE SECTION 106 COMPLIANCE PROGRAM	1	0.81	91.87	
23	INCOMPLETE AND INACCURATE SITE AND SURVEY RECORDS	1	0.81	92.68	
24	STATE SHPO WAS NOT CONSULTED	1	0.81	93.50	
25	INADEQUATE CONTROL OF NOXIOUS WEEDS	1	0.81	94.31	
26	IMPROPER ACCOUNTING OF HUNTING FEES	1	0.81	95.12	
27	INCOMPLETE NEPA DOCUMENTATION FOR PROPOSED TARGET	1	0.81	95.93	
28	NO PROGRAM FOR CONTROLLING NON-POINT SOURCE POLLUTION	1	0.81	96.75	
29	NO NATIVE AMERICAN CONSULTATION PROGRAM	1	0.81	97.56	
30	INADEQUATE COLLECTIONS AND ASSOCIATED RECORDS CURATION	1	0.81	98.37	
31	FEES NOT CHARGED FOR FISHING	1	0.81	99.19	
32	GRAZING PLAN NOT IMPLEMENTED	1	0.81	100.00	
	TOTALS	123	100.00		0

APPENDIX A: ECAMP FINDINGS FOR 33 ACC BASES (Pare', 1994)

ACC NOISE MANAGEMENT

	FINDING	#	%	CUMM %	
1	OUTDATED AICUZ STUDY	12	38.71	38.71	
2	LACK OF BIENNIEL REVIEW OF AICUZ DATA	5	16.13	54.84	
3	LACK OF RANGE PLAN	3	9.68	64.52	
4	NONAVAILABILTY OF NOISE DANGERS IN WORKING AREAS	3	9.68	74.19	
5	AFR 55-34 NOT ON FILE	2	6.45	80.65	
6	LACK OF NOISE ABATEMENT PROCEDURES FOR PILOTS	2	6.45	87.10	
7	FAILURE TO MINIMZE NOISE DISTURBANCES	2	6.45	93.55	
8	FAILURE TO BRIEF COMMUNITY AND EPC ON NOISE PROGRAM	1	3.23	96.77	
9	PUBLIC AFFAIRS NOT INCLUDED IN NOISE COMPLAINTS	1	3.23	100.00	
	TOTALS	31	100.00		

APPENDIX B: ABBREVIATED VERSION OF HQ ACC ROOT CAUSE ANALYSIS

Overview

HQ ACC/CEVP has a root cause analysis method to evaluate regulatory enforcement actions. The purpose is to "provide a method of and explain how to analyze unfavorable conditions or incidents to identify problems, including root causes, direct causes, and contributing causes" (Root Cause Analysis Policy Letter, 16 March 1994). It is designed to work to identify the root problem as a **team** (The team in this case is a base level group selected by the EPC to investigate each incident). Root cause analysis enables Air Combat Command to:

- understand the sequence of events that led to an incident
- see the differences between actual conditions and desired conditions
- determine the root cause, direct cause, and contributing causes
- develop corrective actions by identifying the root cause.

(HQ ACC Root Cause Analysis Policy Letter, 16 March 1994)

The procedure shall be used to do root cause analysis of 1) substance releases (such as an oil spill), and 2) receipt of a regulatory enforcement action.

Definitions

To gain a better understanding of the purpose and scope of this analysis, a few terms that are routinely used in the root cause analysis policy letter must be defined.

Contributing cause. A cause, that if corrected, would not prevent the primary effect but that is important enough to be recognized as needing corrective action to improve the quality of the process or product.

Direct cause. The cause which directly resulted in the primary effect.

Primary effect. The incident or condition that the root cause is trying to prevent.

Root cause analysis. Any systematic process used to identify the most basic reason(s) for an incident, which if corrected, will prevent occurrence or recurrence.

Root cause. The most basic reason(s) for an incident, which if corrected, will prevent occurrence or recurrence. To be valid the root cause must (1) prevent recurrence when corrected and (2) allow meeting other objectives, e.g. remaining in operation.

Systemic factors. Those interdependent activities or elements that interact in an orderly arrangement, one in relation to the other, to facilitate the desired performance of a major activity or organization.

Classifications

ACC/CEVP has determined that the root causes for enforcement action can be separated into the following six categories: 1) training, 2) management and oversight, 3) policy and guidance, 4) manpower, 5) funding, and 6) a miscellaneous other section as follows:

Training - local on the job training (OJT) or refresher certification to correct a worker's failure to apply local procedures, or formal training required. This section accounts for insufficiencies in training content, inadequacies in training presentation, and other training factors;

Management and oversight - any problem resulting from inadequate documentation and local management decisions. This section includes violations for deficiencies in permits, contingency and closure plans, inadequate administrative controls, and inadequacies in hazardous waste inspections.

Policy and guidance - accounts for procedural error due to general failure on the management and staff's part rather than negligence on the part of the indiviuals worker. The facility environmental staff must review its policies and practices and put new procedures into place.

Manpower - requires hiring more people or hiring more qualified people. This category deals with deficiencies such as inadequate staffing and improper work practices

Funding - accounts for deficiency in funds due to non availability, inappropriate usage, failure to request the appropriate amount.

Other - includes deficiencies caused by equipment/material failure, contamination, errors by manufacturers in shipping or marking, inadequate man-machine interface, errors in equipment procurement, and human and non-human external phenomena.

The first three categories lend themselves to analyzing performance problems. This will become a factor in later portions of the paper.

Procedure

Whenever a base receives an enforcement action, the base fills out a root cause worksheet. This worksheet identifies the type of incident, the members of the root cause analysis team, and references any similar incidents in the past. The form asks for the primary effect of the incident, the direct cause, a description of each problem identified as a systemic factor, and the root cause and contributing cause(s). The worksheet gives the base an opportunity to identify what the root cause of the incident and ways to prevent the action from recurring. The basis of the procedure is for the representatives from the appropriate base organizations involved with the incident to work as a team. This procedure makes the base the primary responsible party for the elimination of recurring findings.

After the base has sent the worksheet to the headquarters, the appropriate representative in CEVP reviews the information and documents the cause and the proposed corrective action. The information from these root cause analysis reports is updated whenever a base receives an enforcement action and when an enforcement action is close. The HQ ACC/CC is briefed on the root causes of enforcement actions at a minimum of a least once a quarter.

APPENDIX C: ACC PERFORMANCE-BASED ECAMP FINDINGS (TOTAL OCCURRENCES FY91-FY93)

TOTAL NUMBER OF ECAMP FINDINGS (TOTAL OCCURRENCES)

	HW	HM	POL	SP PRGMS	WATER	PESTICIDES	AIR	S. WASTE	NAT RES	NOISE	TOTALS
NO. OF OCCURS	527	583	330	239	225	210	162	137	123	31	2567
TRAINING	173	36	4	58	13	40	18	23	15	0	380
MGM'T & OVRSGT	193	151	79	150	136	99	65	79	89	6	1047
TRAINING/MGM'T	12	303	0	0	5	0	11	8	0	0	339
POLICY	26	8	0	4	19	5	14	6	6	0	88
POLICY/TRAINING	24	0	103	0	4	2	0	0	0	0	133
POLICY/MGM'T	19	0	0	0	0	0	3	0	0	0	22
TOTALS	447	498	186	212	177	146	111	116	110	6	2009

PERCENTAGES OF ECAMP FINDINGS (TOTAL OCCURRENCES)

	HW	HM	POL	SP PRGMS	WATER	PESTICIDES	AIR	S. WASTE	NAT RES	NOISE	TOTALS
TRAINING	32.83%	6.17%	1.21%	24.27%	5.78%	19.05%	11.11%	16.79%	12.20%	0.00%	14.80%
MGM'T & OVRSGT	36.62%	25.90%	23.94%	62.76%	60.44%	47.14%	40.12%	57.66%	72.36%	19.35%	40.79%
TRAINING/MGM'T	2.28%	51.97%	0.00%	0.00%	2.22%	0.00%	6.79%	5.84%	0.00%	0.00%	13.21%
POLICY	4.93%	1.37%	0.00%	1.67%	8.44%	2.38%	8.64%	4.38%	4.88%	0.00%	3.43%
POLICY/TRAINING	4.55%	0.00%	31.21%	0.00%	1.78%	0.95%	0.00%	0.00%	0.00%	0.00%	5.18%
POLICY/MGM'T	3.61%	0.00%	0.00%	0.00%	0.00%	0.00%	1.85%	0.00%	0.00%	0.00%	0.86%
TOTALS	84.82%	85.42%	56.36%	88.70%	78.67%	69.52%	68.52%	84.67%	89.43%	19.35%	78.26%

APPENDIX D: ACC PERFORMANCE-BASED ECAMP FINDINGS (TOTAL FINDINGS FY91-FY93)

TOTAL NUMBER OF ECAMP FINDINGS (TOTAL FINDINGS)

	HW	HM	POL	SP PRGMS	WATER	PESTICIDES	AIR	S. WASTE	NAT RES	NOISE	TOTALS
NO. OF FINDINGS	89	50	40	40	55	34	53	35	32	9	437
TRAINING	18	3	2	9	4	4	20	5	2	0	67
MGM'T & OVRSGT	33	21	8	26	27	18	9	19	22	4	187
TRAINING/MGM'T	3	16	11	0	4	0	3	4	0	0	41
POLICY	7	3	0	2	7	4	3	2	2	0	30
POLICY/TRAINING	7	0	0	0	2	1	0	0	0	0	10
POLICY/MGM'T	7	0	0	0	0	0	1	0	0	0	8
TOTALS	75	43	21	37	44	27	36	30	26	4	343

PERCENTAGES OF ECAMP FINDINGS (TOTAL FINDINGS)

	HW	HM	POL	SP PRGMS	WATER	PESTICIDES	AIR	S. WASTE	NAT RES	NOISE	TOTALS
TRAINING	20.22%	6.00%	5.00%	22.50%	7.27%	11.76%	37.74%	14.29%	6.25%	0.00%	15.33%
MGM'T & OVRSGT	37.08%	42.00%	20.00%	65.00%	49.09%	52.94%	16.98%	54.29%	68.75%	44.44%	42.79%
TRAINING/MGM'T	3.37%	32.00%	27.50%	0.00%	7.27%	0.00%	5.66%	11.43%	0.00%	0.00%	9.38%
POLICY	7.87%	6.00%	0.00%	5.00%	12.73%	11.76%	5.66%	5.71%	6.25%	0.00%	6.86%
POLICY/TRAINING	7.87%	0.00%	0.00%	0.00%	3.64%	2.94%	0.00%	0.00%	0.00%	0.00%	2.29%
POLICY/MGM'T	7.87%	0.00%	0.00%	0.00%	0.00%	0.00%	1.89%	0.00%	0.00%	0.00%	1.83%
TOTALS	84.27%	86.00%	52.50%	92.50%	80.00%	79.41%	67.92%	85.71%	81.25%	44.44%	78.49%

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Vita

Captain Frederick Bernard Cade was born on 23 May 1964 in Fort Campbell, Kentucky. He graduated with high honors from Niceville Senior High School in Niceville, Florida in 1982 and entered Allan Hancock College in Lompoc, California that fall. He transferred to Christian Brothers College in Memphis, Tennessee in 1984 and he graduated in 1988 with a Bachelor of Science Degree in Mechanical Engineering. Upon graduation, he was commissioned in the U.S. Air Force as a Second Lieutenant and served his first tour of duty at Mather AFB, California. In his first assignment in civil engineering, he served as Chief of Environmental Engineering for the 1st Civil Engineering Squadron, Langely AFB, Virginia until October 1991. From October 1991 to April 1993, he served in the same squadron as the Chief Facilities Programmer. In May 1993, he entered the Graduate Engineering and Environmental Management Program at the Air Force Institute of Technology's School of Engineering.

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REPORT DOCUMENTATION PAGE

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1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	September 1994	Master's Thesis

4. TITLE AND SUBTITLE
DEVELOPMENT OF AN ANALYSIS METHOD TO EVALUATE ROOT CAUSES OF THE AIR FORCE ENVIRONMENTAL COMPLIANCE ASSESSMENT AND MANAGEMENT PROGRAM (ECAMP) FINDINGS

5. FUNDING NUMBERS

6. AUTHOR(S)
Frederick B. Cade, Captain, USAF

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Force Institute of Technology, WPAFB OH. 45433-6583

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GEE/ENV/94S-05

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The Air Force is committed to being a national leader in achieving environmental compliance. This commitment is exemplified by the Air Force Chief of Staff's goal of no "notices of violation." This goal, however, has proven to be elusive. In the early 1990s, the number of Air Force notices of violation (NOVs) increased by 73%, from 103 to 178. One of the reasons may be findings from the Environmental Compliance Assessment and Management Program (ECAMP) are not being utilized effectively.

This research developed an analysis method to identify root causes of ECAMP findings. The resulting model emphasized the use of performance management standards to evaluate performance based problems detected by the ECAMP process. The model incorporated motivational theory, job description, and performance analysis to identify these problems. The research also established a relationship between human performance problems and ECAMP findings.

The results from the analysis of the external ECAMPs of 33 ACC bases conducted from FY91-FY93 indicated that 79 percent of the ECAMP findings were performance based. Based on the research findings, it has been concluded that there is a need for methods that use performance management standards to identify causes of ECAMP findings.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Environmental Compliance Assessment and Management Program, Environmental Management, Performance Management, Motivational Theory Job Description, Performance Analysis	100
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
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